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Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

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[OFFICIAL NOTICE.]

New England Association of Gas Engineers.

BOSTON, MASS., January 8th, 1883.

The Annual Meeting of the Association will be held at Young's Hotel, Boston, Mass., on the 21st and 22d days of February next, commencing at 11 o'clock, A.M., on Wednesday, the 21st of said month.

Members intending to propose the names of applicants for membership, are requested to send them to the Secretary at least two days before the time of meeting.

The Board of Directors will meet in Room 11, on the evening of February 20, at 8 o'clock. Papers to be read before the Association should be forwarded to the Secretary in time to be presented to the Directors, at this meeting, for approval.

Managers, superintendents and engineers of gas companies, are cordially invited to the meeting. Those wishing rooms engaged, will please notify the Secretary on or before February 17th

JOHN ANDREW, H. A. ALLYN, GEO. B. NEAL, } *Committee of Arrangments.*

GEO. B. NEAL, *Secretary.*

[OFFICIAL NOTICE.]

Western Gas Association.

OFFICE OF THE WESTERN GAS ASSOCIATION, QUINCY, ILLS., Jan. 8, 1883.

To the Members of the Western Gas Association:

You are doubtless aware that the Sixth Annual Meeting of the Western Gas Association will be held at Cincinnati, Ohio, beginning on May 9th, and continuing for three days. You are all alike interested in making the coming meeting successful and profitable, as well as pleasant. To accomplish this result you must be aware, from the teachings of past experience, that you cannot continue to rely upon your neighbor for his contribution of interest to the general fund of information, but you must yourself come prepared to add your share of intelligence for the welfare of our common cause.

You are to be congratulated on the fact that our past meetings have been, on the whole, successful; but will readily admit that they would have been still more so, had the members generally sacrificed a little of their time "for the good of the cause," by preparing papers on any of the subjects pertaining to the gas interests, and not trusted to their imperfect memories for their impromptu utterances during the sessions of the Association. We possess in our ranks the talent and ability necessary to prepare those papers which would be so warmly welcomed at our annual gatherings, and let it not be said that we lack energy and inclination. For subjects the field is large enough from which to choose. You are limited in your choice only to those topics having a general or special bearing on matters concerning your profession. If you know of anything new, of any different or improved methods of manipulation from the commonly accepted ones of the past, it is certainly your duty, as it should be your pleasure, to impart to your brother associates such information as you may possess on the subject. The information may in your judgement be seemingly unimportant, yet it may prove of great interest to others.

We have heretofore suffered from a dearth of papers, owing largely to the fact that we have fallen into the error of depending upon others. If it is possible to bring about such a state of affairs, let us for once have a surplus. You have but a few months in which to prepare, and there is no better time to begin than *now*. Until the opening of Spring many of you, I think I might safely say all, have every day one or more hours of enforced leisure on your hands. Let at least a portion of this time be devoted to the object I have named; and you will be as much surprised at the rapidity with which your anticipated difficulties vanish as your fellow members will be pleased to enjoy the fruits of your labors.

In the selection of a subject do not fear that it may be already appropriated by another. Two or more papers on the same subject are entirely permissible, and will add but still more to the interest. Let not the younger and less experienced superintendents of the smaller gas works hesitate to add their mite to the offerings, for information of pronounced value is often gathered from such sources. To those who have not yet joined our Association,

but are desirous of applying for membership at our coming meeting, I wish to say that they will be cordially welcomed, and any papers they may choose to present will receive due consideration.

As regards the length of the communications solicited, that is a matter of minor importance. A few lines often furnish food for thought and profitable discussion. Do not be deterred from presenting a paper because it may lack the formidable proportions of a volume. In a treatise on subjects of a practical nature brevity is seldom a serious fault.

In conclusion, let me again urge upon you the importance which this matter merits, and express the hope, which I trust will be fully realized, that, indvidually and collectively, you will cheerfully co-operate in using your best endeavors to make the next meeting of the Western Gas Association an unqualified success.

A. W. Littleton,
Secretary.

RESIDUAL PRODUCTS.

The fact that American gas companies do not derive the same proportional revenue from the bye-products of gas manufacture as our foreign friends do is so well-known, has been remarked so frequently, that its reiteration might be almost deemed a waste of energy. As, however, it takes little force to make the remark, we may possibly be excused for repeating the assertion on the present occasion. Certainly, whether we be excused or not, we have the temerity to make the remark, feeling as we do that its repetition will lead to good results. There are no good reasons why we should be so far behind our trans-Atlantic brethren in this regard, and our position relatively to the gas industries of other countries will be materially changed to our advantage if each gas manager has our status in this matter kept constantly before him. Certain it is that there are some companies in this country which are recouped by their residual products to the extent of sixty per cent. of the cost of their coal. True, such cases are exceptions. It is also true that the managers of these companies would not have gotten the large returns on this score that they are now enjoying if they had remained ignorant of the results obtained abroad. There is, therefore, sufficient reason for constantly calling attention to our rearward position in the utilization of these auxilliary branches of our business.

But some people tell us that these bye-products are "wastages," and, instead of endeavoring to increase the return from them, our energies should be devoted to reducing their production to the minimum. That as they are an evidence of the imperfection of the coal gas process, we are simply calling attention to our own shame by mentioning them. As a rose is as sweet under any other name, we will not cavil about terms; if it pleases anyone to style coke, tar and ammonia wastages, they are welcome to do so. We know that the American gas engineer is intensely practical; that as long as he derives a good revenue from these side branches he will not stop to consider what name should be given them. And, further, be they wastages or what not, he knows that they can be made to form a barricade which can be made to stand the assaults of water gas, oil gas, or the electric light.

We have said that no harm can come from keeping always in view our exact position in this particular as compared with that in other countries; let us now endeavor to see just where we do stand. It is easy to get data as to results obtained by the works in and around London, and, on the other hand, it is very difficult to get reliable statistics relative to American works. We will not, however, err very greatly if we say that, on the average, gas works in this country will sell 18 bushels of coke to the ton of coal carbonized, which, at 7½ cents a bushel, would bring in $1.35. Tar can be put at ten gallons per ton, equal to 40 cents, while ammonia will net 20 cents. That there are some companies getting better results than those given we will not dispute; that there are some other concerns which would rejoice if their residuals brought them in $1.95 per ton must also be admitted. But the figures named will stand well for a general average.

For foreign figures we can turn to no better source for information than "Field's Analysis." Let us take the average figures given in this book for 1881, taking in the suburban as well as the city works; and after converting the values into American money, place them in juxtaposition with what we have taken as the American results, all reduced to the per ton standard—

	Price of Coal.	Return from Coke.	Return from Tar.	Return from ammonia.	Total.
London..	$3.75	$1.40	$0.54	$0.55	$2.49
American	4.75	1.35	0.40	0.20	1.95

From the above it will be seen that *apparently* we do not run far behind the English results save from ammonia. As regards the return from this product we are woefully distanced. We said *apparently* we almost hold our own with the one exception; we put in the proviso purposely, because as the first cost of our coal is greater than that paid in England, the returns, if figured on a basis of the cost of the coal, would not show to such advantage. This is made clear by the following table, which shows the percentage of the cost of the coal returned by each residual—

	Coke.	Tar.	Ammonia.	Total.
London	37.3	14.7	14.9	66.9
America	26	8.4	4.2	38.6

These figures show us how much ground we have yet to traverse before coming up to the standard set us by the gas companies in and around London.

As high heats are in vogue in most gas works in this country, more coke must necessarily be used in the furnaces than where the coal is distilled at a lower temperature. Nevertheless, by judicious management, this drawback could be fully counterbalanced by getting a better price for the coke that is sold. By judicious management, we say, and that is exactly what we mean. We do not think an engineer shows great perspicuity when he makes a contract with one party for the sale of all his coke, and allows the contractor or go-between to retail it to the consumers. There is no good reason why this matter should not be entirely in the hands of the company's agents, nor why all the profit to be made from the sale of this article should not flow into the company's treasury. No more is it sound policy to make long contracts with factories for the disposal of coke at a low figure. Nor can any greater praise be meted to those who, as soon as their stock of this article begins to run ahead, scared by the sight of a few coke heaps in the yard, rush with precipitous haste to get rid of it any figure. But what we call judicious management is when the householders of a city are made to feel that it is to their interest to use coke, for the private consumers are after all the best friends of a gas company. And that such people can be made to take that view of the matter is evidenced by the work of many gas managers. Two things are necessary; the coke must be broken, and it must be well screened. And we should also add, the matter must be advertised. If an engineer finds himself with a large surplus of this residual on hand, let him have it broken up, and send carts around the city leaving a sample of it at each house, with a handbill describing the best method of using it, and he will find, in the end, that it is a cheap form of advertisement. In other words, by judicious management in this regard—we mean the showing of the same business tact, sagacity, energy and patience as other tradesmen show in the conduct of their business. And then, when, by the pursuit of the policy we have outlined, the coke heaps are all gone, and orders are in ahead of the supply, let the generator and regenerator furnace be called to aid in the good work; let breeze take the place of coke in boiler fires, and the proceeds from coke will represent close upon forty per cent. of the cost of the coal. It can be done, and right in the immediate future; 23 bushels sold per ton of coal, at eight cents per bushel, will do it, and then we would lead our English friends by two per cent.

That the value of tar has advanced of late is a fact which has been noted by many a manager with a great deal of pleasure; nevertheless, as long as the article is used by roofers alone we cannot expect any material increase in this figure. Our friend Page has shown us how great is the value of this residual, the figures read by him at the several Association meetings produced on the faces of his hearers, unconsciously though to them, a smile of intense satisfaction; but, when he had finished, and they, so to speak, awoke from their dreams, and realized how little this article netted them, notwithstanding all Mr. Page's figures of what it might be made to do then the smile of satisfaction vanished. But we see no reason why this matter should be allowed to end in smoke year after year. There is no good reason why this residual should not be worked up under the joint supervision of the gas companies. Until this is done we need not expect an increase on this score of more than ten cents per ton of coal.

We are happy to be able to say that the value of the ammoniacal liquor is being appreciated by gas engineers, and happier yet that many of them have the temerity to stand out against contractors, name their figure, insist that they shall have that amount for the liquor, and stick to their determination. They can well afford to do so; for if the liquor is left on their hands there is nothing we know of to prevent them from working it up into sulphate themselves.

For the present forty cents per ton of coal should be the figure for ammoniacal liquor; and let it be remembered that this is only the half-way house. We must in the future advance beyond this, but the amount named will do for the present.

So, then, there would seem to be no good reason why, in the immediate future, the figure given for the percentage of the cost of the coal derived from the proceeds of the sale of residuals in this country should not be changed to the following—

Coke	40	per cent.
Tar	10	"
Ammonia	8.5	"
Total	58.5	

After we have arrived at this point we can halt a moment—but a moment only—and then having refreshed ourselves proceed on our journey to the haven where we would be, that is, where gas is the bye-product.

Some Legislation Affecting the Price of Street Lighting in Washington, D. C.

In the House of Representatives, on January 5th, when the clause relative to the appropriation for lighting the District of Columbia was reached, Representative Murch, of Maine, offered an amendment to reduce the price paid from $25 to $20, and in the course of his speech on the subject suggested the advisability of lighting the streets of Washington by electricity. This amendment having been lost, Rep. Klotz, of Pennsylvania, moved to reduce the appropriation to $22 per lamp. In support of his motion, Rep. Klotz made some charges, amongst which he stated that the gas company of the District controlled Congress, and tried to manipulate Congressmen. It would seem to us, from Mr. Klotz's own statements, that the control exercised by the Washington Gas Light Company over Congress must be very slim indeed when they were under the necessity "of trying to manipulate Congressmen."

Mr. Klotz acted very wisely, we think, when he ridiculed the idea of lighting the streets of the city of Washington in accordance with a moon schedule. Instead of moving to reduce the appropriation he should have rather moved to increase it, in order that the capital city of the United States should have its streets lighted every night in the year, and during the whole of each night. The average Congressman does not seem to know that it is a very expensive proceeding for a gas company to light streets on an intermittent table, for the gas maker must, of necessity, bear the expense of keeping idle a portion of his working plant on the nights when the moon is supposed to be on duty with an unclouded face.

Sometimes, however, the moon is in bad humor, and "won't come out." On these dark nights, when the moon is invisible, in the neighborhood of "Willard's" and "Ebbit's," congressmen do sometimes reach the state of one of that luminary's phases, and it is then, we should think, that the congressional brain would resolve that the "pale moonlight" was altogether too unreliable, and give the "gas monopolist" a chance to guide his wandering footsteps home at all times of the night.

The amendment reducing the appropriation from $25 to $22 per lamp was carried.

[Official Report—Continued from page 280.]

Tenth Annual Meeting of the American Gas Light Association.

Held at the Monongahela House, Pittsburgh, Pa.,
October 18, 19, and 20, 1882.

Afternoon Session.—Oct. 19.

Mr. George G. Ramsdell then read the following paper:

GAS ENGINES.

Mr. President and Gentlemen of the Association:—Perhaps in no department of mechanics, certainly in none identified with gas interests, has more rapid progress been made than in the introduction of the gas engine. That which a few years ago occupied an uncertain field as an experiment now stands not only a success, but a necessity; it has, by its own merits, advanced its way as a motor power until it now has its place in a majority of the cities of the country where gas is manufactured. All this has come about in the face of obstacles which only a knowledge of its merits could overcome.

It is now only two and a half year since the first large gas engine was put in operation in this country. This engine, of 17-horse power, was placed in a grain elevator at Vincennes, Ind., and, it is needless to say, its developments were anxiously awaited by the gas fraternity, for upon its success largely hinged the future of the gas engine in this country. Fortunately, it most abundantly filled the requirements, and marked the beginning of a rapid enlargement of the introduction of the gas engine. Indeed so marked were the results obtained with this, that scores of even larger sizes are now in successful operation in this country; and the manufacturers, after twice doubling the capacity of their works, are now five months behind their orders, and this feature constitutes the most serious obstacle presented to the adoption and introduction of these machines. Engines of 25-horse power are now manufactured and in use in this country, and in one instance, I am informed by the makers, three of equal power are applied to the same shaft, thus affording 75-horse power.

My own experience leads me to the belief that each year's intelligence will greatly increase the demand for and usefulness of these engines. It is the universal verdict of those who use them, and who perform the important feature of paying the gas bills, that for economy, safety, durability, and convenience they are very far preferable to steam as a motive power, while in small sizes, and where the labor performed is intermittent, there is absolutely no comparison.

I have, as opportunity offered, jotted down the results obtained by various engines in practical operation, and give them as follows:

Of nine gas engines used as freight and passenger elevators, with a total of 32 horse power, and in operation 9½ hours each per day, the results were as follows:

Average cost per hour per engine			$0.063
"	" day	"	0.585
"	" month	"	15.25
"	" hour	"	0.0178
"	" day	"	0.165
"	" month	"	4.29

In a printing office in my own city the following labor was performed by a 1½-horse power engine, with gas at $2.50 per thousand feet:

Number of Daily issued during year	125,000
" Weekly " "	110,000
" impressions equal to job work done	25,000
Total impressions	260,000

Cost of Gas.

November	$1.25	May	$1.50
December	1.25	June	1.75
January	1.00	July	1.25
February	1.25	August	1.25
March	1.25	September	1.00
April	1.25	October	1.25

Total cost one year	$15.25
" per day	.0487
" " impression	.00005

In the handling of grain the results obtained by several engines show the average expense to be .07 of one cent per bushel to elevate from the sink or dump into the storage or shipping bins, and from thence load into cars; while the shelling of corn costs less than one-fifth of one cent per bushel to dump the corn by drag belts into the sheller, shell and clean, and elevate into storage and shipping bins, and deliver into cars.

Add to these small items of expense the advantages of complete safety, unaffected insurance, economy of space, entire freedom from coal, dirt, ashes, kindling, etc., together with the fact that so little attention is required by the engine that nine-tenths of a man's time is available elsewhere, and an engineer's or stoker's wages practically saved, and you have the cheapest, most complete, and most desirable motive power in use to-day.

The importance of this to the gas interests of the country is very great, considering that nine-tenths of the gas consumed would be in the daytime, while our plant is comparatively idle, and as the consumption, especially in the larger sizes, forms a saving in services and meters.

The President—Are there any suggestions to be made or questions asked in regard to these papers?

Mr. Forstall—I think the facts stated by Mr. Edgerton in his paper are very important. I would like to know if, in the course of his experiments, he has ascertained any comparative data as to the calorific power of the different gases made in New York city—for instance, of the Municipal or Mutual gas, as compared with the Manhattan. In other words, taking a 30-candle gas at the same price as a 19 or 20-candle gas, what would be the advantage, for heating, of the rich gas as compared with the poor gas—one being made from coal and the other from oil and water? I should be glad to have Mr. Edgerton enlighten us on this subject.

Mr. Edgerton—I prepared this apparatus for the purpose of making those tests, but as yet have only tested the Manhattan gas with it. It was designed to set at rest the theories with regard to the calorific power of gas. As Mr. Goodwin's tabulated statement shows, the calorific power is calculated from the quality of the gas. There is a great deal of dispute as to whether that is accurate and reliable. The object to be attained by my apparatus is to find out what amount of heat is realized in practice per cubic foot from the consumption of various gases. I have only carried the tests out with regard to the Manhattan gas. I have not tried all the gases of New York, but I can tell from other experiments which I have made that the heating power of gas goes up in nearly the same ratio as the illuminating power. It is not quite as great. I made an allowance of 10 per cent. to equalize the heating power, and I found that this allowance was too great. There was not that difference. For instance, 40-candle gas is 2½-times the illuminating quality of ordinary coal gas, while its heating capacity is a little more than twice that of ordinary coal gas.

The President—Would that reconcile the facts as set forth by Mr. Goodwin as to the comparative values of hydrogen gas and ordinary illuminating gas?

Mr. Edgerton—Hydrogen gas has very little illuminating power by volume; by weight it has more heating power than any other gas. But we do not sell gas by weight, but by volume; and therefore hydrogen stands lowest in the list. There is a mistaken notion that water gas containing hydrogen is a powerful heating agent. Such is not the case. It has less than one-half the heating power, per cubic foot, of coal gas. I may state, in this

connection, that the calorific power of such gases as the Lowe and the Municipal gas is due almost entirely to the oil portion of the gas, and not to the water.

Mr. Littlehales—I will mention a fact coming under my own observation bearing upon the query of Mr. Forstall. In one of the Canadian cities gas engines are being made. They are adjusted, when made, to water gas. In three cases which have come under my own observation, where they have been fixed to work with coal gas, they would not work until the adjusting screw had been closed, so as to use a very much less quantity of coal gas than they had been adjusted for when using water gas—thus showing that a less quantity of coal gas would run the engine than was required of water gas. That fact has come under my own observation in three instances. They were adjusted for one gas, and had to be corrected for the other.

Mr. Pearson—I suppose Mr. Littlehales refers to the gas engines manufactured in Toronto. He must bear in mind that those engines were made for gas of a higher gravity, and required more pressure and a larger opening than for gas of a lower gravity. I have not personally tested this more than once, and therefore do not wish to speak with the utmost positiveness; but, as matter of fact, judging from statements made by quite a number of people who use these engines in Toronto, the average quantity of gas used per horse power is only 18 feet; while from Mr. Goodwin's statement the average quantity used with the ordinary coal gas is from 20 to 22 feet. From the statements of Mr. Goodwin and Mr. Edgerton, it is evident that the more illuminants there are in gas the greater is its calorific power. There happens to be in the gas in Toronto between 8 and 9 per cent. of illuminants, while there is not so much in the ordinary coal gas. This is determined by the Principal of the School of Natural Sciences. I was surprised at the results obtained. As a matter of fact, from a number of tests made in Toronto, the average was as I have stated—18 feet per horse power. I intend, when I return, to institute more particular tests, and shall be ready to report thereon at the next meeting of the Association, if I am present.

Mr. Somerville—Mr. Ramsdell's paper was well worthy of listening to; but I must confess that I would have listened with greater satisfaction if he could have told us how to get the gas engines. We have about seven at work in Indianapolis, and I am satisfied, if we could have got them, that we could have had twenty-seven at work. I do not know how it is with others, but we cannot get them when we order them. We ordered one in July, but it has not yet come to hand. I came here trusting than I might get some satisfactory information about gas engines, and where they could be bought. There is no trouble in introducing the gas engines, if we could only get them to sell. I would like to get some information upon that subject.

The President—I will say, in reply, that Mr. Goodwin, who has recently been abroad, has paid particular attention to the necessity of increasing the chances of procuring that of which we so stand in need; and he is able to give us some information upon the subject of gas engines other than the Otto.

Mr. Pearson—The Otto style of engine is made in Toronto. I do not know whether you could import from Toronto without infringing the patent. I was instrumental in getting a manufacturer to commence operations in Toronto, by ordering a number for our company, and knowing that there was no patent on the machines in Canada. They are now sold there at the following prices:

2-horse power, with base	.....	$350
4-horse power "	.....	500
7-horse power "	.....	680

We have now in use 18 gas engines, of from 2 to 7 horse power; and it may be a matter of interest to members to know that although a good many of them were in use for only a few months, the gas consumed by these engines during the year amounted to within a fraction of one million feet. I am satisfied with the success which has attended their introduction. I have a number of testimonials from the parties who have used them; and I expect the number in use will be largely increased the coming year.

Mr. Goodwin—I do not see how we can be benefited by the Toronto engines in this country, as the patent laws would prevent us from using the engines here were we to import them.

A Member—Is there more than one manufacturer of gas engines in this country?

Mr. Goodwin—Not of the Otto engine; the manufacturers of that engine control the patents. I will say, Mr. President, that while in Europe I investigated the gas engine question quite thoroughly. I examined a number that came under my observation, and I succeeded in finding one that will, I think, fill the bill. You have probably heard of it; it is called the Clerk gas engine. I hold in my hand an address by Mr. Clerk on the "Theory of the Gas Engine." I will not read it, for it is a very lengthy document. If the publishers of the American Gas Light Journal feel like reprinting it I will give them a copy. It contains a vast deal of information upon the theory of the gas engine. I thought that a good gas engine was a desirable thing to have, and I have taken the preliminary steps to secure that engine. This was quite a year ago. Like your experience in getting the Otto engine, my experience, with my friend Mr. Stein, in getting possession of this engine, was equally slow. But I will tell you how far we have got along, and can probably give you a little information concerning it which will enable you to judge of it for yourselves. After coming to terms with regard to the control of the engine, I made it a condition, before signing papers, that certain questions should be answered regarding the engine; and the answers I will read to you, with your permission. [Mr. Goodwin then read the questions and the answers received in reply from Messrs. Thompson, Sterne & Co.] The next step was to have one of each size of engine manufactured and imported, a board of experts selected, and questions and answers submitted, and have the engines tested upon the basis of each one of those questions and answers. If the engines conform to the tests, steps have been taken by other gentlemen, with myself, to give you an engine that will probably answer the bill, and relieve you of the difficulty you now have with regard to getting engines. At least I hope so.

Mr. Harbison—Can Mr. Goodwin give any information as to the probable length of time that will elapse before the engines will be ready for the market?

Mr. Goodwin—Mr. Sterne is expected in this country with his engines, and with competent men to superintend their construction, next month, with all the plans and specifications necessary to construct the engines. I can say, further, that three or four of the largest establishments in this country are ready and anxious to take hold and manufacture them. All we want is to see that the engine will do what they claim for it. The document which I hold in my hand gives more light upon the theory of the gas engine than any other paper which I have read.

Mr. Edgerton—I understood Mr. Goodwin to make one statement with regard to the consumption of gas in the engine, which I think is rather unfavorable to it. He said that there was 600 horse power per ton of coal developed by the gas engine, from the gas alone, leaving two-thirds of the weight of the fuel in reserve, in the coke. Is that correct?

Mr. Goodwin—What I intended to state was this: 12,000 feet of 20-candle power gas per ton of coal, divided by 20, gives 600 horse power, as realized from that amount of gas.

Mr. Edgerton—That is correct so far as the gas goes; but for comparative purposes it results that in the gas engine you use only one-third of the weight of fuel, whereas from the solid fuel you use it all, and have a larger amount to work on.

Mr. Goodwin—I am afraid you do not understand me. I said that if you could realize, according to the theoretical value, all that was in a ton of coal, it would be one-sixth of a pound of coal per horse power, and you would get 13,440 horse power from a ton of coal. Whereas, if there are 10 pounds of coal used to develop one horse power, you realize but 224 horse power per ton of coal.

Mr. Edgerton—I understood that statement; I was only trying to get your comparative statement of the values of solid and gaseous fuel. You stated the horse power developed from a ton of coal, in gas; whereas that gas is developed from only one-third of the coal, and you have the coke left.

Mr. Goodwin—You are correct; I simply dealt with the question of the gas, without including anything else.

Mr. Coombs—I would like to ask Mr. Goodwin if he knows anything in relation to the speed of the new engine of which he speaks. Can the speed be varied?

Mr. Goodwin—It can be changed by varying the quantity of gas used.

Mr. Coombs—Can it be made to run 50 or 100 revolutions per minute?

Mr. Goodwin—Certainly; but you will have the same power.

Mr. Coombs—I understand that the speed of the Otto engine cannot be varied, but that it must always run at the same speed.

Mr. Slater—Mr. Ramsdell has given the cost per horse power for various uses, but he did not mention the price of the gas.

Mr. Ramsdell—It was $2 per 1,000 feet.

The President—Is it correct that the Otto engine cannot be varied in speed?

Mr. Ramsdell—That is correct. The Otto engine has to run at a certain number of revolutions, the variations being governed by the amount of gas used.

The President—In addition to the governor which controls the flow of gas there is also a valve which controls the quantity of gas delivered. By changing that valve can you not run the engine at a lower rate of speed, or, by turning on more gas, run it at a higher rate of speed?

Mr. Ramsdell—I believe not. There are different speeds for the different sizes of engines; but the rate of speed cannot be changed.

Mr. Helme—The Otto engine is regulated by a governor; when the speed gets below the standard, more gas flows in. It is kept at about 180.

The President—That is true of a continuous supply of gas; but suppose you cut off one-half of the supply—what would be the result?

Mr. Helme—The engine would stop.

The President—Suppose you cut off one-tenth of the supply?

Mr. Helme—The result would be that the speed would go down, and the engine would stop.

Mr. Starr—When you are using the full power of the engine you take gas at every third revolution; but it always has to run at 180, and it will run that way all the time.

Mr. Spencer—In the Otto engine the governor is operated entirely by the speed of the engine. Whenever the speed gets up to the maximum the governor moves the cam, so that it does not take any more gas until the speed is reduced, as suggested by Mr. Helme. But the very moment that it gets to a certain point it shifts again, and takes some more gas. So that the maximum and minimum speeds are kept within a very small range. You cannot vary the speed. It will either run at that speed or it will not run at all.

Mr. Ramsdell—I think that one of the great troubles arises from this fact. The engine depends upon volume in the supply of gas; and for that reason it is usual to hang one or two gas bags over the engine so that there may be a constant volume of gas there. Then it requires very little pressure for the gas to flow into the openings whenever the governor opens. But the speed of the engine is that which regulates the supply of gas—it is not the governor.

Mr. Helme—Did you ever try overloading the engine, and keeping the speed down, so that the governor will keep the cam in contact with the cam wheel all the time? If so, what is the effect?

Mr. Ramsdell—I have tried that; and the effect is to absorb the gas that is in the receiver or gas box until there is not a sufficient quantity to flow in and keep up the supply, and then the engine will stop. It will take the gas as long as there is enough to keep it going; then the engine begins to lose speed, and will stop.

Mr. Spencer—My understanding of the thing is that if you overload it, so as to bring the speed down below the regulated point, the engine will stop, and will not run at all.

Mr. Ramsdell—Yes; in other words, it will not perform more than its capacity.

Mr. Helme—Mr. Goodwin has mentioned the fact that the Clerk engine takes in gas at every revolution of the wheel. To my mind that would be a decided advantage; because the Otto takes in only at every other stroke. While taking in no gas, and when no explosion takes place, the engine loses speed. In the Clerk engine that speed will not be much reduced before the next explosion will take it up. That is not the case with the Otto.

Mr. Ramsdell—I think that we are getting a wrong impression in that respect. I should not suppose that the Clerk, or any other gas engine which is automatic in its supply, would have the same number of admissions of gas when operating as a four-horse power engine as are required when operating as a seven-horse power engine. If the Otto, or any other engine, is working at its full capacity it must take the gas at every revolution, or it cannot maintain its speed. It would be so with any size. I have been asked if I have ever made that experiment. When we were running the 17-horse power engine I was very anxious to see if we could check the power and see how it corresponded with the power actually required in the elevator. Of course, we never need any less amount of power, except in shelling corn. They have a drag belt 300 feet in length, by which they drag the corn out of the corn house and throw it into the corn shovel. By loading that drag belt very heavily we could choke the engine down. That was the way I arrived at the number of feet used per horse power. Of course we had no indicator there by which we could measure it. Mr. Pearson states that with his gas in Toronto it only required 18 cubic feet per horse power to operate it. That was the result with this engine. When the engine was working at its full capacity—17 horse power—it consumed 18 cubic feet of gas per hour per horse power.

Mr. Helme—As you crowded this engine, and gave it more than it was calculated to do, it came to a stop?

Mr. Ramsdell—We crowded it until we stopped it. We could overfeed this belt; but, so long as we put on just what it would carry, it would work all right. We were trying to see if we could lower it down.

Mr. Helme—As I understand the Otto, it takes gas at every other revolution.

Mr. Ramsdell—That is a wrong impression; it takes gas only when it requires it, whether it be once every revolution or once every six revolutions. If the load is such that it requires the admission of gas at every revolution to maintain the speed, it will take it. The governor is automatic in its action. If the work being done is only one-half the capacity of the engine, it will only require half the amount of gas, and it will be admitted just half the number of times.

Mr. Helme—I am afraid that you are laboring under a mistake there. If you will count the teeth on those beveled wheels you will find that one has twice as many as the other, and that the flywheel revolves twice while the cam shaft revolves once.

Mr. Ramsdell—I am not speaking of the revolutions of the flywheel, but of the revolutions of the cam shaft, which admits the gas.

Mr. Littlehales—There is one point lost sight of as to why the speed of the engine cannot be altered, and that is the fact that the quantity of gas admitted depends upon the time taken for the lever to pass over the cam. If you are running at a slow speed, the valve would be open for a longer time, and you would get too much gas for a proper admixture. By 180 revolutions per minute is simply meant 90 pumping revolutions, or 90 explosions per minute. So if it were running slowly it would take the lever a longer time to pass over the cam; there would be too much gas coming in, and you get it past the explosive point.

Mr. Ramsdell—I have found considerable trouble in starting the Otto engine, and I have nearly always found that it results from the fact which Mr. Littlehales has suggested. When the engine is working at proper speed it regulates itself. It takes in just so much gas and air; and the admixture is correct for an explosion. In starting the engine, if we open the valve too wide, so that in passing over the cam slowly there is too much gas admitted, the gas having a pressure and the air no pressure, the gas forces the air back, and it will not ignite. Very frequently, by simply shutting off the valve and working the wheel two or three times, until a sufficient part of that gas is exhausted to form the proper admixture, it will unite and explode, and go right ahead. I think the trouble in starting the engine arises from admitting too much gas. I do not think you can admit too little. We barely open the valve, so that but very little gas will come in. The first explosions are weak and faint; but it is very easy, after the first explosion, to catch up and to go ahead at the requisite speed.

Mr. Nettleton—I have recently put up a 25-horse power engine in the town where I live, to be used either by itself or to supplement other power derived from either a steam engine or a water wheel. To make the two powers work together easily, the normal speed of the connecting shaft must be the same, whether run by one power or the other, or by both. By a mistake in the size of the pulleys, the gas engine was found to run a trifle too fast for the other powers. This was easily changed by weighting the governor; but the variation in the speed was not a great one. As to whether the speed would run down by overloading the engine, my experience has been that with large pipes leading to the engine, and with the cam held in such a position as to take gas every time, the speed will run down to a low point. I have seen this 25-horse power engine run as low as 100; the normal speed is 140. How much lower it will go I cannot say. I listened to Mr. Ramsdell's paper with a great deal of interest, and I am sorry to say that I have not the hopes which he entertains with regard to the gas engine business, except for small powers, or when power is needed intermittently. I think, with gas at or near its present average selling price, the cost will be found too great to allow large powers to be used permanently, or anything above 7 or 8 horse power. I have jotted down some figures which seem to bear me out in this statement. If 22 feet are allowed per indicated horse power per hour, a 25-horse power gas engine will consume 550 feet per hour, or 5,500 feet in ten hours. At $2 per thousand the cost would be $11 per day. The cost for labor and fuel in running a steam engine of about 25-horse power can be made of the following items: Allowing a consumption of 7 pounds of coal per hour per horse power, the consumption would be, for 10 hours, 1,750 pounds, which, at $5 per ton, will cost $4.37. To this add $1.50 for labor, and the sum is $5.87 for the steam engine, as against $11 for a gas engine. Or, figuring a 15-horse power engine in the same way, the gas will cost $6.60 as against $4.12 for coal and labor for a steam engine. For small powers the cost is about the same. I think that for 2 or 4, and probably for 7 horse power engines, people will pay $2 per thousand and be content, with coal and labor at the prices they now are. But beyond those sizes I am quite confident that it is almost impossible to sell gas at $2 per thousand feet for producing power. For intermittent powers, however, I think there is nothing so cheap as gas. A man can run a 25 or 50-horse power engine with gas very cheaply, provided he does not run it too many hours per day.

A Member—When the engine was running at 100 revolutions per minute was it doing any work?

Mr. Nettleton—Yes; this 25-horse power engine was attached to a blower in a large foundry. The speed dropped down, but the blower kept turning. It did not turn so fast, and of course did not furnish so much air.

A Member—For what length of time did the engine run?

Mr. Nettleton—I do not know; I watched it for only fifteen or twenty minutes.

Mr. Littlehales—It takes about one-fourth of the total consumption to overcome the friction of the engine itself. Take, for instance, a 2-horse power engine consuming 43 feet per hour, when doing full duty; if that engine is run free, without doing any duty, it will take about one-fourth of that. So that about three-fourths would be available for power, and one-fourth taken up for the friction and play of the engine itself.

Mr. Helme—You will find that to be the case with the steam engine also.

The President—Are there any other queries with reference to the matter

under consideration? If not we will listen to the reading of a paper by Mr. Wm. Farmer, of New York, on "Marsh Gas."

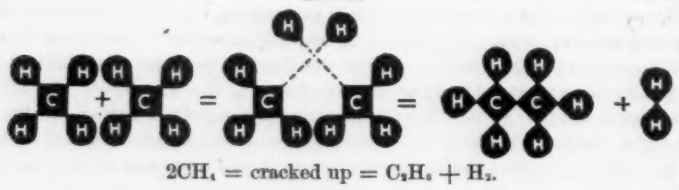
Mr. Farmer's paper was then read as follows:

MARSH GAS (CH_4).

According to theory, marsh gas (CH_4) may be converted into any of the products as given in the following equations:

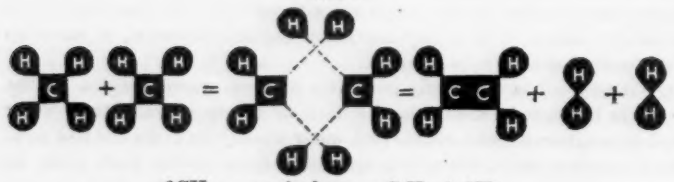
Let the symbol represent an atom of carbon (C) with its four combining points; and let the symbol represent an atom of hydrogen (H) with its one combining point.

No. 1.



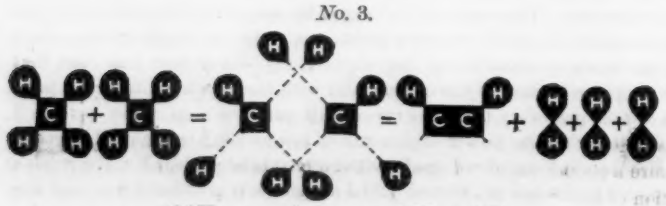
$2CH_4$ = cracked up = $C_2H_6 + H_2$.

No. 2.



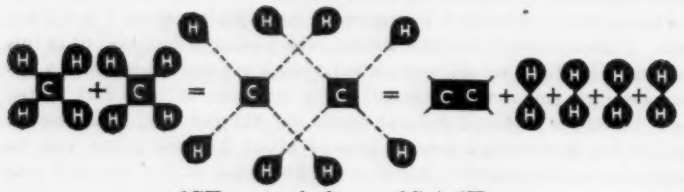
$2CH_4$ = cracked up = $C_2H_4 + 2H_2$.

No. 3.



$2CH_4$ = cracked up = $C_2H_2 + 3H_2$.

No. 4.



$2CH_4$ = cracked up = $2C + 4H_2$.

By the first equation we obtain 1 cubic foot of ethane (C_2H_6) and 1 cubic foot of hydrogen from 2 cubic feet of the marsh gas (CH_4), and the specific gravity of the product will be 0.553.

By the second equation we obtain 1 cubic foot of ethene or olefiant gas (C_2H_4) and 2 cubic feet of hydrogen from 2 cubic feet of the marsh gas (CH_4), and the specific gravity of the product will be 0.368.

By the third equation we obtain 1 cubic foot of ethine or acetylene gas (C_2H_2) and 3 cubic feet of hydrogen from 2 cubic feet of the marsh gas (CH_4), and the specific gravity of the product will be 0.276.

By the fourth equation we obtain 1 cubic foot of carbon vapor (which will be converted into graphite and lampblack) and 4 cubic feet of hydrogen from 2 cubic feet of the marsh gas (CH_4), and the specific gravity of the product (exclusive of the carbon) will be 0.069.

According to Berthelot, marsh gas (CH_4), exposed to the action of a strong heat, or to the spark of a strong induction coil, will produce one volume of ethine or acetylene gas (C_2H_2) and 3 volumes of hydrogen, as we have shown in the third equation.

The ordinary illuminating coal gas contains about 40 per cent. of marsh gas (CH_4), which gives but a feeble light when burned alone.

If the whole of the marsh gas were converted into acetylene and hydrogen, as per equation 3, then we should obtain about 40 per cent. more gas from our coal, of a greater candle power. Instead of getting 5 cubic feet per pound of coal, we should then get about 7 cubic feet, with a higher candle power.

NOTE.—The illustrations used in the above paper are from William Farmer's "New System of Teaching Chemistry."

The President—I believe we are now through with the indicated programme, and with the consideration of matters of which we have had notice. The Association is now ready, in the hour which we have yet remaining, to entertain any business matters of a miscellaneous character which may be brought before it.

Mr. Harbison—We have had brought to our notice at this meeting of the Association several carefully prepared and able papers, indicating on the part of the writers a great deal of thought and study. I move that the thanks of the Association be extended to all the gentlemen who have favored us with papers during the session.

The motion was unanimously agreed to.

Mr. Harbison—Every gas manager has from time to time brought to his attention various matters and articles connected with the industry, and representations with regard to the merits of a particular thing which may be presented to us. We do not have opportunities then and there to compare them with other articles of the same general nature. I wish to suggest to the Local Committee of Arrangements for our next meeting, in New York, the advisability of having various articles manufactured in connection with our industry brought there and placed on exhibition under the care of the various manufacturers, so that we may have an opportunity to compare gas burner with gas burner, retort setting with retort setting, gas meter with gas meter—and, in short, everything else connected with our industry. I have, during the year, as I have met the representatives of various manufacturers at my place, suggested the matter to them. They have uniformly said that they would be glad to participate in such an exhibition. It was generally understood, a few years ago, that the Association would not permit itself to be bored by the representatives of various manufacturers bringing articles into the Association room during the meetings; but it seems to me that an exhibition such as I now suggest would be of great value to the members of the Association, and especially to the engineers who come from a distance, as giving them an opportunity of comparing the merits of the various mechanisms which were placed on exhibition. I move, therefore, that the Committee of Arrangements be requested to take the matter into consideration, and to carry it out if they shall think it advisable.

Mr. Anderson—I second the motion. I, for one, as a manufacturer, am willing to be an exhibitor. I suppose that the best way would be for the Committee to make inquiries of manufacturers, and ascertain if there is a sufficient number who will be willing to exhibit. I, for one, am willing, and I hope that others will fall into line.

Mr. Harbison—I should be glad if the Committee would decide to try such an exhibition next year in New York, and write manufacturers to send in their exhibits if they wish to do so, and those who do so would reap whatever advantage there might be. I have no doubt that competition would secure an interesting exhibition. It could be done with no expense to the Association, except, perhaps, that which might be incurred in securing a suitable room.

The motion of Mr. Harbison was agreed to.

Mr. Price—While I was listening to the address of the President yesterday morning, in opening the session, I was much impressed by some of the suggestions and recommendations which were made; and it seemed to me that portions of the address, having the character of suggestions and recommendations should be referred to a committee or committees for investigation and report at the next meeting of the Association. I have been puzzled to know just how to get at it, or just how it should be arranged. I have talked with some gentlemen upon the subject, and they agree with me that it would be a good thing to do if the work were well done. I therefore move that a committee of three be appointed by the Chair to take up the address of the President, and to make a report at the next meeting of the Association upon certain important matters which are therein recommended. There was one suggestion made in the address, recommending some sort of an affiliation of the gas companies of the different States for mutual advantage. There are several other suggestions which ought to be discussed. The committee might be instructed to take up the points of special interest, and report upon each. Perhaps one committee could do all of the work. I wish to say, in this connection, that I do not wish to be on the committee, as circumstances may very likely prevent my acting. I hope the Association will approve the suggestion, and that a good, strong committee may be appointed to take up the points which will readily occur to the gentlemen who heard the address, and make such report thereon at the next meeting as they may deem best.

Mr. Wood—I think the suggestion of Mr. Price is of great importance. Heretofore we have not paid sufficient attention to the annual addresses of the President, and very many important suggestions have escaped our attention. I second the motion of Mr. Price, and trust that he may be one of the members of the committee.

The President—I would suggest, Mr. Price, as an amendment, that you name the committee in the resolution.

Mr. Price—I beg to be excused from doing that.

The President—It seems rather indelicate for the President to appoint a committee to consider his own recommendations.

Mr. Price—I cannot see the slightest indelicacy about it. You would be simply acting under the instructions of the Association.

Mr. Watkins—I would suggest, as an amendment to the resolution, that the President-elect be requested to name the committee.

Mr. Price—I accept that amendment; it is a good suggestion.

Mr. Greenough—I would suggest, if that committee is to accomplish anything of real value, that the members ought to be appointed from the same part of the country.

The resolution of Mr. Price was then unanimously adopted.

The President—The committee will consist of three members, who will be announced hereafter,

Mr. Harbison—In my opinion, one of the reasons why there has not been more attention paid to the suggestions and recommendations made by former Presidents in their opening addresses, has been because, having listened to the reading of it, and possibly having re-read it when printed in the AMERICAN GAS LIGHT JOURNAL, the paper has been then filed away, and perhaps not again referred to. To remedy that evil (and I think it is an evil, because the recommendations have often been well worthy of careful consideration), I move that the Secretary be requested to have 300 copies of the President's address printed in pamphlet form, and distributed at an early day among the members of the Association.

The resolution was seconded by Mr. McElroy, and was then unanimously adopted.

Mr. Slater—No action has been taken as to the disposition of the funds of the Association. According to the Treasurer's report there is about $1,500 on hand. I suppose that, without further instructions, the Treasurer will deposit the money in the savings bank, as he has done heretofore.

The President—He will if he is a prudent Treasurer.

The Secretary—The former Secretary introduced the custom of depositing the funds where they shall draw interest. They have been drawing interest ever since I have been Secretary. My action will be to transfer the money into a draft on New York, and when I get there deposit in a savings bank. It will remain there, subject to call for the expense of printing, and other incidental expenses, during the year.

Mr. Harbison—We are nearing the close of this meeting, and it has been evident to me, as it must have been to every member of this Association, that the gentleman who now fills the Chair, and who has performed the duties of President during the past year, has done so in an exceedingly able and business-like manner, I move you, Mr. Secretary, that the thanks of this Association be tendered to the retiring President for the very able manner in which he has performed the duties of his office during the past year.

The motion was put by the Secretary, and was unanimously adopted by a rising vote.

The Secretary—Mr. President. it is my pleasure to convey to you, by the unanimous vote of the Association, its thanks to you for the impartial and gentlemanly manner in which you have presided over their deliberations.

The President—Gentlemen, my thanks are certainly due for this very graceful, although unmerited, compliment. My regret is that during the past year my business engagements were of such a character that I was unable to devote the time and attention I desired to the duties of the office you so kindly conferred upon me. My interest in the labors of this Association, and my estimate of their importance and value, cannot be exceeded by that of any other member, and I therefore feel that, although we have been drawn closer together by our Association meetings, there is yet much room for strengthening the bonds of fellowship; and it should be the sincere desire, as well as the untiring effort, of every member to bring about that result. The peculiarly local character of our business, and the engrossing nature of its duties, unfortunately confines us within very narrow territorial limits. We have but few opportunities of mingling together, in either the business or social relations of life, and I therefore most heartily approve of these annual meetings; and although we are sometimes hurried away, and frequently have to leave before the full measure of the benefits and amenities of the occasion are enjoyed, yet I feel that in separating to-day we shall all return home better satisfied with ourselves, better satisfied with our fellow members, and better satisfied with the progress we are making in the business in which we are engaged.

The Secretary—I am requested by the President-elect to announce the committee selected by him to take into consideration the recommendations and suggestions contained in the President's address. William H. Price, A. C. Wood, and Eugene Vanderpool.

On motion of Mr. Somerville, a vote of thanks was tendered to Mr. Wm. H. White, the Secretary of the Association.

Mr. Wood—I move a vote of thanks to the Pittsburgh Gas Light Company for its courteous invitation and kind treatment of us—for what we have already received and and are yet to receive during our stay in Pittsburgh.

Mr. Price—I take great pleasure in seconding that motion.

The President—That motion was in substance adopted this morning; but, in view of the very courteous and hospitable treatment which we have received, I can see no objection to repeating the expression of our thanks.

The motion was agreed to.

The Association then adjourned.

The Generator Furnaces of the Munich Gas Works.

[Translated for the AMERICAN GAS LIGHT JOURNAL, by A. P. TRAUTWEIN, from the *Journal fuer Gasbeleuchtung.*

The *Journal fuer Gasbeleuchtung*, for November, contains a most interesting description, contributed by Drs. Schilling and Bunte, of the generator furnaces of the Munich gas works, which have become noted for their high efficiency in point of economy of fuel and carbonizing capacity. The authors maintain that the principles involved in the construction of generator furnaces are so well and generally understood that the furnace as used in its present form at Munich may safely be considered as a standard type which leaves little room for further improvement either in principle or in constructive details; it may be said to embody all features which extended practical experience, and a series of the most thorough scientific investigations have shown to be essential.

The Munich generator furnace is one of the class in which the gasification or incomplete combustion of fuel is accomplished with the aid of a supply of both air and steam. The advantages of this method of working were first clearly demonstrated by the series of experiments on the efficiency of generator furnaces, which were conducted several years ago, by Dr. Bunte, at the instance of the German Society of Gas Engineers. It appeared from these that, even when using the most obstinate kinds of coke, the formation of clinker can be readily and wholly prevented by the admission to the generator of a quantity of steam. Aside, however, from the convenience of not having to contend with any clinker, there is the great advantage that where the fire remains clean, the air supply to the furnace remains constant and continuous, the gasification proceeds regularly, and natural draft alone is sufficient. The fire does not require frequent attention, since the light and loose ash produced may be allowed to accumulate to quite a depth without seriously affecting the regularity in operation of the furnace.

In a furnace of this class it is therefore a matter of very great importance to ensure a proper supply of steam. Usually this is provided for by direct radiation of heat from the fuel in the furnace. In the Munich furnace, with a view of ensuring greater economy, the steam is generated by the waste heat of the products of combustion just previous to their exit from the furnace. This arrangement has the advantage of making the amount of steam supplied directly dependent upon the amount of fuel consumed; as the volume and temperature of the furnace gases are increased or diminished, the evaporation proceeds more or less rapidly, thus always ensuring a proper supply of steam.

The heat absorbed by the steam thus supplied to the furnace, for the purpose of preventing the fusion of the earthy constituents of the coal, is in no sense lost to the furnace; the hydrogen and carbonic oxide, formed by the chemical action of the carbon on the steam, yield, during final combustion, the exact amount of heat abstracted from the furnace. Great care is taken to provide for a thorough mingling of air and steam previous to their entrance into the furnace; it was found that unless such precaution was taken, the air and steam would seek separate channels for traversing the fuel and, although an excess of steam be used, clinkers would form throughout the furnace. The air supply for the final combustion of the generator gases is heated, as a matter of course, and even the primary supply for the generator is similarly heated by the waste gases. The flues for the passage of the gaseous products of combustion are so arranged in this furnace that the gases, after having been utilized in the bench proper, travel downward in a direction opposite to that of the currents of air to be heated. The drawings accompanying the paper exhibit clearly the construction of the furnace; every possible precaution seems to have been observed with a view to utilize the heat and prevent losses by radiation and conduction.

The bench thus fired is one of eight retorts, seven being oval in section, 20½ inches wide and 11¼ inches high; the eighth is circular in section, and 16 inches in diameter; the retorts are 9 feet 9 inches long.

These furnaces, in their most improved form, have been in regular use at the Munich gas works since 1881. A very complete series of experiments was made with a view of determining their efficiency. A stack of six benches was used, and three sets of experiments were made; the first in the Fall of 1881, very soon after they were put into service; the second in February and March of 1882; during the Summer months they were idle, but were fired up in September, without any repair, when they were made the subject of the third series of experiments. The coal used in all these experiments was Saar coal, with 10 per cent. of cannel coal.

The following are the average results obtained—

Gas made per bench per 24 hours	81,200 cu. ft.
Coal carbonized in 24 hours	16,170 lbs.
Coke used as fuel in 24 hours	1,760 lbs.
Proportion of ash in coke	14 per cent.
Gas made per retort per 24 hours	10,150 cu. ft.
Gas made per bench per charge	13,533 cu. ft.
Gas made per pound of coal carbonized	5.02 cu. ft.
Coal carbonized per retort per 24 hours	2,020 cu. ft.
Coal carbonized per retort per charge	336.6 lbs.
Coke used per 100 lbs. coal carbonized	10.8 lbs.
Coke used per 1000 cubic feet of gas made	21.6 lbs.

It was found that the furnace lost none of its efficiency by being repeatedly put into and out of service; this is due to the fact that the flues are so arranged as to be but little affected by changes of temperature; four years of experience with furnaces of the older type abundantly demonstrate the value of this method of constructing.

Numerous observations were made on the quality, temperature, and composition of the generator gas. The following was found to be the average composition by volume—

Carbonic acid	8.6 per cent.
Carbonic oxide	20.6 "
Hydrogen	15 "
Nitrogen	55.8 "

The average temperature of the generator gas was 1150°C. The average composition of the products of combustion was—18 per cent. of carbonic acid; 1.5 per cent. of oxygen; 80.5 per cent. of nitrogen; and occasional traces of carbonic oxide and steam. The composition of the gases was found to be quite uniform, and the percentage of carbonic acid did not vary more than 1.5 to two per cent. immediately after and before cleaning the fires.

The temperature of the gases, upon leaving the bench, was 1400°C; the air for final combustion was regenerated to 1000°-1100°C., thus reducing the temperature of the gases to 900°; the gases in passing downward next heat the air supply for the generator to 350°C; they then generate the steam and, finally, enter the chimney flue at 550°C.

If we summarize, in round numbers, the results of these operations, we find that were it not for the principle of regeneration here employed, the final temperature (1400°C) of the products of combustion upon leaving the bench would represent a loss in fuel of 64 per cent. By regeneration the temperature is reduced to 550°C., thus reducing the loss to 25 per cent. The heat thus restored is accounted for as follows—

20 per cent. goes to the air supply for final combustion; six per cent. to the air supply for the generator; five per cent. to making steam, while the remainder is lost in radiation and conduction.

General Management of Small Works.

Much time and thought have been given to the subject of a proper and economical management of works, and it is truly one of vast import and unlimited extent—especially at the present time when the demand for cheaper and better illumination is being steadily and persistently pressed upon us.

The value of coals has changed but little during the past few years; labor is not a whit cheaper; nor can lime and other materials entering into the economy of a gas works be obtained at more favorable rates.

We cannot, therefore, look to any of these elements for a solution of the problem as to how we can reduce the cost of manufacture, and thus accede to the demand made upon us. There is thus left us the fact that if we could cheapen our product it must be done from an increase in our manufacture and a proper disposition of our residual products.

The day has passed when a product of 4.25 cubic feet per pound of coal is conceded to be good management; as a result higher heats are used, and a general average of from 4.80 to five cubic feet is given us, being an increase of over 15 per cent. gained to the credit of manufacturing account. Another point that must be aimed at is the increase of production per bench and per man.

Various, I was about to say as the sands of the seashore, are the modes of setting our benches. Each one claiming great superiority in results for his style—and yet producing different results in different localities, and under different managements. I do not propose to enter into any detailed discussion on this subject—I simply wish to present, as a means of increasing our yield per bench, the idea of employing various sizes of retorts in the same arch. For instance, a bench of "threes" could be set with two 14×26, with top 15×30, or larger sizes. A bench of "fives" having the two bottom retorts 14×26, next, 14×28, and top 15×30, or larger; a bench of "sixes" in the same ratio—thus drawing the retorts closer together as they are set in the bench, placing them immediately over the furnace, and giving a material increase in the capacity. This would certainly prove successful, and not only increase the product per bench, and save fuel, but also give a greater yield with a minimum cost of labor. I know of several works where this system has been in successful operation for some time, and the results have been more than could have been anticipated. A company in New York is now experimenting on a bench of "sixes," the bottom retorts being 16×28, middles, 16×30, tops, 16×32, with mouthpieces 14×26.

Another point to be looked after closely is the manner of heating our benches most economically—that is, to obtain a good high heat, but one that shall at the same time be even and uniform through all parts of the arch. Many indeed are the patented regenerative furnaces which are being experimented with in our larger works. But, from present indications, I cannot say they are so shaped as to be of any great value to the majority of smaller companies. Again, they are expensive, and have not reached that point of success which I think would warrant a general adoption of any one of them; still they are being daily improved, and will, without doubt, some day be considered a necessary part of a well-equipped works. There are, however, other means at present employed that are cheaply constructed and produce beneficial results, and, above all, are not patented.

At the New England Association meeting, held in Boston in February last, much time and attention was devoted to this subject, and Mr. Starr, of Richmond, Indiana, gave his experience with a pseudo recuperative furnace of home manufacture, an account of which, with the discussion thereon, was published in the American Gas Light Journal of April 3d, and as all have probably read that article it is needless for me to describe it again; but I would suggest that, instead of using an iron chamber to heat the air, the use of a double clay retort, of proper size and well-built around, as being a more perfect heater, and from which there would be but comparatively little loss by radiation; the pipes could then be carried down across the benches, and into the flue and furnace, as described by Mr. Starr; and I am sure that your results will be so much increased as to amply indemnify you for the cost of putting up the work, and which, of itself, cannot be expensive.

A close attention to detail in the retort house will demonstrate, in a very short time, and practically, that it is in there the money is to be not only made but saved or wasted; and while it is a matter of fact that an extensive business, be it of what kind it may, can and may afford a margin of waste, there are but few who can allow this to the matters under their control, and, consequently, must put forth every effort, and see that every element yields its fullest result, that nothing is wasted—for truly with us the old Scotch proverb, "mony a mickle maks a muckle," applies with absolute truth and positive force.

The subjects of condensation and purification are also matters of vital importance. You may produce a good gas in your retort house, and then rob yourself, by condensing the very life out of it a few moments after. The subject is one too vast to enter into in detail in such a paper as this. One could not have time to take up and consider the various claims that are put forth for the various styles of and manner of working them. Newbigging gives as an axiom "that thorough condensation is half purification," and then leaves each one to formulate in his own mind at just what point, and by just what means, that thorough condensation begins or is an accomplished fact. The main point, in my estimation, to be looked at is to reduce the temperature of the gas just as slowly as possible; and a great aid to condensation is to have good-sized mains, and of as great a length, between the hydraulic main and condensers, as possible to keep the gas as long as may be in contact with the tar, at a proper temperature, and no longer; because in the one case it enriches the product with its vapors—in the other, its chemical affinity becomes so great as to detract from the illuminating power of the gas.

Scrubbers are also of patterns *ad infinitum*, and if we propose to act economically here is one point where we can make our residuals return to us an income through the sale of our ammoniacal liquor—and is a question to which at least a fair share of attention should be given.

Purification is an item of expense that can be materially lessened. If lime is used those having kilns can reburn the same and use it over again with equally good results, and thus make what was once an eyesore, and an expense for removal (I refer to spent lime, now improperly called), a source of revenue to decrease the cost of purification.

The various preparations of iron are surely inexpensive, even in the beginning. True it is that if you would purchase the prepared article from manfacturers you must pay well for it; but you can prepare it yourself, at an almost nominal cost, and achieve just as good results. One thing, however, must be remembered in the use of iron, and that is this. Should we avail ourselves of the benefit to be derived from the sale of our ammoniacal liquor, eliminating all the ammonia from the gas before it reaches the purifiers, it will be necessary to use some lime in connection therewith to enable us to remove the carbonic acid, since the chemical element for the absorption of the carbonic acid is gone. That element is ammonia, with which the carbonic acid unites, forming carbonate of ammonia, and is thrown off during the process of revivification in that form.

One last suggestion. Always keep your works in the best possible condition, for then and only then can you hope to obtain good results. To so act is economy in its truest sense. A small sum annually expended will keep your works in perfect condition, whereas if allowed to run for a few years without any repairs it will cost thousands to rebuild them as they should be. Step by step, little by little, add such improvements as have been practically tried and have been proven good, and your results must be all that can rightly be looked for. X.

Is it Desirable for Gas Companies to Undertake the Manufacture of Sulphate of Ammonia?

Mr. Robert Jones, of Dewsbury, read the following paper on the above subject at the last meeting of the Manchester District Institution of Gas Engineers—

If any apology is necessary for troubling you with a paper on a subject with which you are all no doubt tolerably familiar, that apology must be the pressing invitation which I received from our Secretary. Personally, I admit that I should have preferred to delay the matter until I had had an opportunity of judging, from a whole year's working, whether the results are such as to justify the course that was taken in deciding to erect the plant. Still, having become a member of this Institution, I felt it my duty to do whatever lay in my power to further its interests. At all events, if my paper does not possess any intrinsic merit in itself, it will serve as the opening to a discussion which may be the means of eliciting valuable information from those members who have had special experience in this branch of our operations. In these days of keen competition—when there is a demand for good gas at a cheap rate, and when the hopes of prosperity to gas companies are largely involved in the question of increased consumption, especially in the daytime—it becomes the duty of every manager not to allow a single matter to be neglected which may prove a source of profit.

Statements have been made from time to time that sulphate making is outside the legitimate sphere of a gas company or gas supplying corporation; but I consider it essentially the duty of a manager, in the interest of the public, to manipulate the residuals in such a manner as to realize the greatest possible results. For my own part, I should not hesitate to propose to my committee not only the manufacture of sulphate, as we are doing at present, but also the distillation of tar, if I had reason to believe that we should gain any advantage by so doing. The sulphate plant which is in use at the Dewsbury corporation gas works was erected on the recommendation of my predecessor, Mr. Armitage. I do not know what amount of profit he anticipated we should make; but I doubt not he will be pleased to hear that there is a prospect of such results as will justify the course he took in making the recommendation to the committee. I refer to this because I was somewhat sceptical at first; and I make this statement in the light of the experience gained in the actual working of the plant.

The merits and demerits of the various processes adopted for the manufacture of sulphate have at different times been brought before this and kindred institutions, and therefore I do not intend to enter into a comparison between one class and another. My chief object in writing this paper is to put such information before you as will assist you perhaps in deciding the very important question which stands at the head thereof.

It may, perhaps, be well for me to give you a short description of the plant in use at Dewsbury; and I will do so very briefly. A full description of the process may be obtained on reference to the paper which Mr. Hindson of Newcastle read before the members of the Gas Institute at the meeting in June last. The plant consists of two circular stills, 10 feet in diameter and 10 feet deep; two closed saturators, six feet by six feet four inches; two settling tanks, six feet by four feet, and four feet deep; and two evaporators nine feet by six feet, and one foot four inches deep. This plant is intended to make two tons of sulphate per day. I may say, however, that we have never been able to make this quantity in 24 hours; the largest amount being about 34 cwt. This possibly may be because we are careful not to change stills until we are fully assured that there is practically no ammonia left in the liquor.

The stills are placed at different elevations, so that the liquor in the top one can be run off into the bottom after all the free ammonia is drawn off. The top is charged with about ten tons of liquor; the quantity and strength of the same being carefully noted, so as to ascertain if we are not producing good results. Steam is turned on until all the free ammonia has been driven off. The liquor is then run into the lower still and lime added, which liberates the fixed ammonia, and the top one is refilled. Steam is then turned into the lower one. The steam was originally applied in a wrought iron coil; but at the suggestion of Mr. Collinge, of Rochdale, I altered it, so that at the present time wet steam is used. The object we had in view at the time of making the change was to agitate the lime by the jets of steam, instead of using the mechanical agitator provided. It answers its purpose admirably, and the result is more efficient working and a decided saving in labor. The ammonia (with the steam which rises from the bottom still) passes through a six-inch pipe to the bottom of the top still. This pipe ends in a perforated branch. The heat thus applied to the bottom still is sufficient to keep both boiling.

The ammonia gas leaving the stills passes into a closed saturator which has been charged with about 16 cwt. of brown oil of vitriol of a density of 150° Twaddle. This is diluted with water to about 70° Twaddle—a density rather higher than is usual in most works; but the condensed steam from the stills dilutes the liquor sufficiently to prevent the formation of crystals. The ammonia enters the saturator through a perforated coil at the bottom, and is immediately absorbed by the sulphuric acid. In about 12 hours the acid becomes thoroughly neutralized. The ammonia is then turned into another saturator similarly prepared. The liquor is subsequently run into a settling tank, where it is allowed to remain until the liquid is quite clear; it is then run into the evaporator, which is fitted with steam coils. As the liquor becomes concentrated by the application of heat, beautiful white crystals of sulphate of ammonia are formed. These are fished out with a wooden shovel and allowed to drain; and the sulphate is then ready for the market. The sulphureted hydrogen evolved by the decomposition of the sulphate of ammonium is absorbed by being passed through oxide of iron.

I am not going to say the plant is the best that can be adopted—indeed, to my mind, it is a question whether the extra expense, both in the erection and working of it, is compensated for by the superior quality of the resulting material; but there cannot be the slightest doubt as to the quality of the salt produced. If it is not chemically pure, it is almost so. I tested a few samples, and the average percentage of ammonia in the dry salt was 25.23 per cent.; the theoretical percentage being, as you are aware, 25.75. The quality, therefore, leaves little to be desired. But the question often presents itself to my mind—How is it that so many of the largest manufacturers prefer to manufacture a grey sulphate? The explanation which several have given me is that the extra expense incurred in producing a white salt is more than can be made up by the extra price realized by the article. Possibly there is considerable truth in this; for you find as a rule manufacturers are ever ready to take an advantage when it is within their reach.

In reference to the question as to whether we find it to pay to manufacture our own liquor, I have been frequently asked to state how much we realize per ton of coal carbonized. Now I submit that this has no bearing whatever on the subject; and if I give this information it will but tend to mislead. The only method by which the results can be ascertained is to take the marketable value of the liquor produced, together with the cost of manufacture, and compare it with the revenue from the sale of the sulphate. This I have carefully done; and, after allowing a very fair amount for depreciation on the plant—viz., 15 per cent.—and 4 per cent. interest on the outlay, I find we are able to produce one ton of sulphate of ammonia at a net cost of £17 1s. The difference between this sum and the price we realize per ton is, of course, profit. My committee have for the present decided not to contract for the disposal of their sulphate, the market being in a very unsettled state; but we have made some very satisfactory sales, realizing in certain cases £20 net cash on the works, though, of course, we have sold at lower prices. These results are so far satisfactory; and having verified them from actual working I bring them before you with confidence. The only part on which I am doubtful is the question of depreciation; but in this case I believe my estimate of 15 per cent. will be large enough to cover it, especially as some of the repairs can be undertaken without any increase of our present staff. I may say it is possible we shall obtain even more favorable results as time goes on; for, as you know, there is generally some deficiency in new plant, and ours was no exception to the rule.

Such results as those I have laid before you are sufficient to justify any company in undertaking the manufacture of its own liquor, providing the situation is as favorable as the one at Dewsbury. You will understand that because we make a profit at Dewsbury it does not necessarily follow that it is possible to be done at every works; for there are many circumstances there which operate in our favor. In the first place we are in the midst of a district where sulphate is largely used, and we are enabled at our works to obtain a price in many cases considerably in excess of that of the Hull market. This is an advantage; for the carriage alone to Hull is 8s. 4d. per ton, while in addition there are charges for weighing, loading, and frequently deductions for short weight. Beyond this we have a plentiful supply of water free of cost, ample boiler power, plenty of storage for liquor, and fuel at a very low price; indeed the material we are using for this purpose we should have some difficulty in disposing of at any price. Again, in almost all gas works there is at times surplus labor, which can in this manner be turned to account with very great advantage.

In making my calculations I have taken the basis of our last contract to ascertain the value of our liquor—viz., 2s. 6¼d. per unit per ton of sulphate of ammonia. It may be said that I have taken too low an estimate of the value of the liquor; but I do not think that a higher price would be offered now in the face of a falling market. We have for years past sold our liquor

by the actual amount of ammonia present; the price per ton being, as I have said, 2s. 6¼d. per unit per cent. of sulphate of ammonia. This would average for a 5° liquor about 22s. 6d. per ton. I know that there are some works where what at first sight appears to be a higher price is obtained; but no comparisons can be fairly made except on the basis of the actual amount of ammonia, or what is the actual price received per unit of sulphate in every ton of liquor disposed of.

If those who sell liquor in its raw state decide to continue to do so, I would strongly advise them to discontinue the crude methods which are adopted in many places to ascertain its value. Twaddle's hydrometer is sometimes used; but there is really no connection whatever between the density of ammoniacal liquor and the amount of ammonia it contains, unless the exact chemical composition of the liquor is known and taken into consideration. The composition of ammoniacal liquor, as you all know, is extremely variable, depending in a high degree upon the methods adopted for washing and scrubbing the gas, and the extent to which such operations are carried. Another method is the saturation test, which is undoubtedly a better process than the other, but not very reliable, because the amount of fixed ammonia in the liquor does not exist in a constant ratio. It is almost incredible that gas managers should have gone on making contracts on the basis of these crude and indefinite means of valuation, whilst better and more reliable methods are known. An idea seems to prevail that Twaddle's hydrometer is to the advantage of the seller; but it is not so. A purchaser can always give a higher price for an article when he knows what the actual value of the article is. Sometimes, of course, sellers have an advantage, as in the case where improvements have been made in the washing and scrubbing arrangements after contracts have been entered into; but this is only a temporary advantage, not to say an unfair one, which will right itself when the next contract is entered into.

I will not attempt to deny the fact that manufacturers have a very considerable advantage over gas companies in connection with the sulphate manufacture. They can erect their works in the most favorable positions, where there are the greatest facilities for the transit of their goods; while a gas company, if they erect sulphate plant, do it on their own premises, if they have any spare ground; and though I am aware that many gas works have erected with regard alike to the advantages of railway and canal communication, still there are others which are not so favorably situated. Manufacturers on a large scale have the advantages of good business associations, and are enabled to profit by any change in the market; while in the case of corporations they mostly contract for one year's make, and thus, while lessening the risk, necessarily reduce the profits. Still, if it can be shown that, notwithstanding all these risks and disadvantages, it is possible to make a profit out of the manufacture of sulphate, it is advisable that it should be undertaken. It may be thought that it is perhaps a small matter after all, and that the profit is not much compared with the ordinary profits of the company. In our case I may say that the profit we have derived, and hope to derive, is such that I was able to recommend my committee to reduce the price of gas 1d. per thousand cubic feet more than they otherwise would have done. This, to my mind, is no inconsiderable item, even in our works; and what would it represent in some of the larger towns?

One question which I have been asked to reply to is—At what price does it pay to sell liquor, and at what price does it cease to pay? This, of course, is a question to which one can scarcely give a definite answer; but I may say that, in my opinion, where anyone is at present realizing £14 for that quantity of their liquor necessary to produce one ton of sulphate of ammonia, this is the time when it pays him to sell it, as there is really very little margin left. If the amount received is much less than that, then it will pay him to manufacture the liquor himself.

I may here remark that gas companies, as a whole, have benefited largely by the action of those who have energetically undertaken the manufacture of sulphate, for undoubtedly manufacturers have been forced to give a much higher price than they otherwise would have done. It is the duty, therefore, of every gas manager to qualify himself to undertake the necessary duties in connection with the disposal of his residual products. Gas managers have not been slow to prove that they are alive to the spirit of progress which is abroad; and I doubt not that, as from time to time the necessity for greater knowledge arises, they will be found equal to the occasion.—*Review of Gas and Water Engineering.*

Gas Poisoning in New York.

That the American public is very good-natured and long-suffering was remarked in an extract from a leading New York newspaper published in the *Journal* a short time since. This observation referred at the time to the inconvenience patiently endured by the New York public for the benefit of a fresh set of claimants to the use of the subsoil of the city streets. The same apathy must extend, however, not only to the laying of pipes in the streets, but also to what is contained in them, and distributed into houses in this manner. It is declared, for example, that fourteen persons have been suffocated or poisoned by gas in New York since the 1st of July. The victims have been of all ages and of both sexes, the last being a policeman. The deaths in every case have occurred during the night, and are traced to escapes of gas into the air of bed-rooms after the occupants have fallen asleep. It is well known that a portion of the gas supply of New York is made from wood and mineral oil, and therefore contains a large proportion of carbonic oxide. It is almost time, it may be thought, that this extraordinary epidemic of gas poisoning were made the subject of strict inquiry. If half the given number of inhabitants of London had perished in a similar manner during the past year, the gas companies would probably have heard of the matter in some unmistakable manner.—London *Journal of Gas Lighting.*

[Our esteemed contemporary is slightly in error as to the mode of manufacture of the water gas supplied in New York city. While one of the companies supplies gas made essentially as described, two others make their gas by the decomposition of steam, by means of incandescent carbon, which gives a gas consisting of about half hydrogen and half carbonic oxide. This is then carbureted by the addition of naphtha, and a brilliant gas is furnished the public which contains from 25 to 33 per cent. of carbonic oxide. The killing qualities of this gas, when inhaled, have been quite well demonstrated since its introduction; but, nevertheless, the people must have something new and scientific.]

Water Gas.

Prof. C. v. Marx read, some time ago, before the Engineering Society of Stuttgart, a very carefully prepared paper on the subject of "Water Gas." Prof. A. A. Breneman has made a translation of this paper from the *Analytischen Chemie*, for *Van Nostrand's Magazine*. We make the following extracts, which give the author's ideas concerning the extent to which the water gas process is worthy of practical application:

"Theoretically, nothing is gained or lost in the water gas process; the same quantity of air is necessary to burn the gas as to burn the coal from which it was originally made.

$$C + O_2 = CO_2$$
$$C + H_2O = H_2 + CO$$
$$H_2 + CO + O_2 = H_2O + CO_2$$

"The process serves only to transform solid fuel into gas, in which latter form it can commonly be burned with better effect. On the whole there is a loss of heat, however, since the water which serves the ends of the process must finally be heated to the temperature at which the products of combustion escape, and its relatively high specific and latent heat must be taken into account. It follows from this that for large heating operations a special generator, close to the heating chamber, is better than a water gas furnace, and that even the simultaneous introduction of steam and air into the generator is disadvantageous, although in this case none of the heat produced in the generator is lost, because the immediate transfer of the hot gas into the heating chamber leaves no opportunity for the heat to escape. The case is different when the gas developed in the generator is allowed to cool before reaching the heating chamber. In this case it is worth while to use the heat of the generator in part for the production of water gas, the greater part of the heat taken up in the decomposition of water in the generator being set free again in the heating chamber of the furnace—that is, it is useful in this case to pass a mixture of steam and air through the generator, and thus to produce a mixture of water gas and generator gas.

"For the purpose of a commercial gas, water gas presents decided advantages over generator gas when we consider the great cost of mains for distribution of the gas. The greater the heating effect of the gas the greater is the practicability of distributing it, and the more effective is the system of pipes by which it is carried. As the heating power of water gas is about four times that of generator gas, and as the distribution of the latter requires the conveyance of 70 per cent. of worthless nitrogen through a costly system of pipes, it may be dismissed from consideration as a commercial gas. Illuminating gas, however, has a certain advantage over water gas, as this has over generator gas, since its heating power is about double, and the cost of producing water gas must be considerably lower than that of illuminating gas, in order that it may compete with it as a heating material. The possibility of this flows, however, from the fact that the cheapest combustible matter may be used, and that the whole material is converted into gas by a process which is much cheaper in efficiency and labor than the ordinary coal gas process. It may perhaps even now be of advantage in large gas works to use a water gas furnace in connection with the retort furnace during the time of greatest consumption in winter, and to prepare carbureted water gas to mix with the ordinary gas. Such gas is easily made of illuminating power equal to that of the best coal gas.

"The superior efficiency of the water gas furnace is apparent when we consider that an ordinary retort yields only 150 cbm. of coal gas in 24 hours. In Frankfort 2,500 cbm. were made daily, corresponding to the production of

17 retorts. Quaglio asserts that such furnaces may be made to do the work of 60 retorts, and will be cheaper in cost of working as the production becomes greater.

"If water gas can be made sufficiently cheap, which can hardly be questioned, and if gas lighting should be surpassed in the future by electric lighting, illuminating gas will not even then be entirely abandoned, and heating gas will be carbureted by the consumer at his house by a special apparatus, using petroleum naphtha or some such material to give luminosity to the gas.

"Water gas, owing to its high per cent. of carbonic oxide, is very poisonous, as also is common illuminating gas. The latter has, however, the estimable property of smelling so strongly that 1-10,000th of it can be detected in the air by its odor. Water gas, on the other hand, has scarcely any smell. This last objection may be met by mixing with the gas some strongly-smelling volatile matter—a device which presents no great technical difficulty.

"It appears from the preceding that the water gas process, under certain conditions, has a future before it, and in a limited sense it may be justly designated as the 'fuel of the future.'"

Prof. Breneman adds an appendix to the translation. One of the items contained therein is a method of making water gas sufficiently strong smelling, which, to say the least, is a very peculiar manner of accomplishing the desired end. The Professor proposes the following:

"A small quantity of sulphur, such as water gas commonly contains, and which it is, for many purposes, unnecessary to remove, suffices to give a decided odor to the gas. This sulphur exists largely, if not entirely, as sulphureted hydrogen, and is easily removed by absorbents when its removal is demanded."

Gas vs. Electric Light in Down-Town Stores.

A correspondent of the *Sanitary Engineer*, who signs himself "X.," makes the following communication to that publication:

Dear Sir:—Perhaps the following statement about the comparative cost of the Edison lamps and gas in a printing establishment (E. P. Coby & Co.) in this city, may be of interest just now, when the public is waiting, with some anxiety, the outcome of the effort to supplant gas by incandescent lamps in down-town stores.

In the establishment in question, the Edison lamps were put into the counting-room, first floor, on trial, to get a basis on which the cost could be afterward adjusted, and for this first month's trial the lights have been free. Within a few days, however, the company have sent out a statement of the amount of light given between certain dates, and the value of it on the basis on which hereafter they will charge their consumers, viz., $1 per 1,000 candles, which, according to the company, is about equivalent to gas at the present rate—$2.25 per 1,000 cubic feet. This, however, does not seem to be the case, at least with this establishment, as the following facts will indicate.

There are seven of the Edison incandescent lamps in the counting-room, of the ordinary size in down-town stores, to replace five gas burners. Owing to defects in the carbons, which have usually left one of the lamps useless, it has been necessary to light one or sometimes two gas burners in addition to the electric lamps. Under these circumstances, a statement is rendered by the Edison Company for the period from October 10 to November 13. Total amount of light furnished was 13,246 standard candles, for which, had the company charged their proposed price of $1 per 1,000 candles, the cost would have been $13.25. Messrs. E. P. Coby & Co. estimate that, taking both cloudy and fair weather together, the lamps have burned possibly five hours on an average daily.

At about the same time this statement was received from the Edison Company, the Mutual Gas Light Company rendered their bill for gas used in the press room and composing rooms. Connected with one meter are 25 six-foot burners on the two floors, and also the one or two which are used in the counting room. Of this number 23 are regularly lit, including those in the counting room, and burning on an average 1½ hours per day. The gas furnished by the Mutual Company, as appears from the weekly statement in the *Sanitary Engineer*, has an illuminating power of 25 and upward. The price of gas is $2.25 per 1,000 cubic feet, and the bill for the burners enumerated, from October 23 to November 22, was $10.35—representing a consumption of 4,600 cubic feet of gas.

Now, assuming that 6 of the 7 electric lamps were always in good order and lighted during the 5 hours per day when artificial light was necessary, the case would stand thus:

Six lamps, 5 hours each, = 30 hours per day; 23 gas burners, 1½ hours each, = 34½ hours per day,

Number of days from October 10 to November 13, 34; total hours of electric lights for that period, 1,020.

Number of days from October 23 to November 22, 30; total hours, gas burners, for that period, 1,035.

Cost of 1,020 hours, electric lamps, $13.25; cost of 1,035 hours, gas burners, $10.35, or about 30 per cent. in favor of gas.

The hours in which the gas burners were lighted have, in the opinion of the gentlemen named, been rated low as compared with the hours during which the electric lamps were burned, and in reality the facts would be rather more favorable for the gas.

As to the quality of the light furnished, it is the opinion of Messrs. Coby & Co. that the gas burners gave more light than do the lamps. An experiment made by turning off one of the lamps at the rear of the office and turning on a gas burner, and then reversing the test, seemed to prove their opinion correct; certainly the gas light appeared to illuminate that part of the office better than did the lamp.

It is to be noticed, in conclusion, that this comparison is with gas at $2.25 per 1,000 cubic feet—a price which it is believed is much above what the gas companies are able to furnish gas at, if they choose to do so.

I have submitted these facts to you for your opinion, fully recognizing that the data given are few in number to base a general opinion as to the cost of electric light and gas on. Still, as we have here, side by side, the bills of both the gas company and the electric light company for the same season of the year, each bill rendered without any thought that it would be used for comparison, the figures cited may be taken as a finger pointing to the real facts in the present dispute between gas and electricity.

The Loiseau Artificial Fuel.

At the regular meeting of the Engineers' Club, of Philadelphia, Pa., held on Saturday, December 16th, Mr. Henry G. Morris in the chair, Mr. E. F. Loiseau, introduced by Mr. Washington Jones, read a paper on the subject of his artificial fuel, which he exhibited, in process of consumption, in the club room grate.

After giving a short historical sketch of the manufacture of artificial fuel in Europe, where "briquettes" have been made for years past, Mr. Loiseau said that the aim of inventors has been to manufacture small lumps in paying quantities and, so far, the attempts have been failures. Sixty-eight fuel factories are successfully operated in Europe, but they all make brick-shaped lumps, too large for family use. Mr. Loiseau claims to have solved the problem, and states that the Loiseau Fuel Company at Port Richmond cannot supply the rapidly increasing demand for the small egg-shaped lumps (weighing about two ounces), which they manufacture at present. Mr. Loiseau described at length his process, and the machinery used for mixing and pressing into lumps the coal dust and pitch, of which the fuel is made. He replied to the criticism of pitch fuel, with regard to its odor, by the practical exhibition in the grate; and presented the following as the result of the tests made in the American Institute of New York, by Prof. J. E. Denton, of the Stevens Institute of Technology:

1st. That the Loiseau fuel evaporates more water to the pound than ordinary anthracite.

2d. That the quantity of ashes is smaller.

3d. That these ashes contain no clinkers.

Mr. Loiseau demonstrated its insolubility by the exhibition of specimens which had been placed in jars of water. The specimen of the fuel was found intact and the water clear. In the consumption of the fuel in the grate no offensive odor could be detected, and it was noticed that the lumps retained their shape while burning, and threw off a great amount of heat.

COMPOSITION.

	Chestnut Anthracite.	Loiseau Fuel.
Carbon	73.40	82.01
Hydrogen	3.09	2.56
Moisture	0.44	2.41
Ash	17.95	10.47
Oxygen and nitrogen (by difference)	5.12	2.55
Theoretical Calorific Power, British Thermal Units	12339.50	13853.00
Equivalent to the evaporation from and at 212° of lbs. water	12.76 lbs.	14.33

Extent of the Anthracite Coal Beds of Pennsylvania.

Charles A. Ashburner, M.E., of Philadelphia, Pa., says that a great many estimates have been made of the total contents of the anthracite coal beds of Pennsylvania. These estimates, however, have been based upon data of a very general nature, and their authors never claimed for them any great accuracy. The areas of the fields have never been carefully measured, so that it would necessarily be impossible to determine with much exactness the to-

tal contents. These estimates can be better made after the completion of the Geological Survey.

The following table gives what he considers the most accurate statement of the areas that has ever been made. With the exception of the Panther Creek basin, the area of which has already been determined by the Geological Survey, the table is compiled mostly from the estimates of Mr. P. W. Sheafer—

Northern Coal Field	198	sq. miles.
Eastern Middle Coal Field	37	"
Western " "	91	"
Southern " " (exclusive of Panther Creek)	130	"
Panther Creek Basin	12.5	"
Total area	468.5	

Transmission of Power by Electricity.

The *Journal of the Society of Arts* states that a novel application of the electrical transmission of power has lately been made at the Trafalgar collieries, Forest of Dean.

The electrical arrangements were carried out by the Pyramid Electric Company, under the supervision of their managing director, Mr. A. Le Neve Foster. In this case an electric motor is used to drive a pump in the underground workings. The pump is employed for pumping the drainage water from some of the deep workings to the bottom of the shaft, from whence the ordinary steam pumps raise it to the surface. The total vertical lift of the electric pump is 115 feet, whilst the length of pipes through which the water is forced is some 500 yards.

A dynamo machine is placed on the surface for generating the current for working the motor, and is connected to it by wires led down the shaft and along the workings, a distance of some 500 yards. Messrs. Brain, the proprietors of the collieries, express themselves perfectly satisfied with the result of the undertaking, and propose still further to extend the utilization of electricity as a motive power.

Counteracting Sulphuric Acid.

According to *Knowledge* Dr. Jule has made the following experiment—he suspended two plates of finely-perforated zinc, one three and the other 12 inches above a gas burner. At the end of three months the lower plate showed an accumulation of the ordinary brownish-black deposit and a furring of sulphate of zinc, but the upper plate was only slightly affected. He concludes from this examination that a single plate of perforated zinc, about a foot square, placed over a gas jet is sufficient to retain most of the noxious emanations.

The Annual "Joker."

Assemblyman Mulholland, of Kings County, has introduced the annual bill which proposes to regulate the price and quality of gas in the cities of New York and Brooklyn. The bill provides that hereafter the gas companies in the two cities named shall supply gas of 17-candle illuminating power, and shall be allowed to charge but $1.50 per thousand cubic feet. The bill also makes the usual provision for the appointment and maintenance of meter inspectors, etc. If Assemblyman Mulholland would tell all he knew about making gas, we think that even he himself would be astonished at the smallness of his knowledge on the subject. But these are the kind of men who are constantly and consistently "striking" at the gas companies—with their "weather eye" ever on the lookout for the main chance.

Gas Matters in Hartford, Conn.

The directors of the Hartford Gas Company held a special meeting on Monday, Dec. 18, and decided to make a reduction of 5 per cent. (from $2 to $1.90) in the price of gas, the reduction to date back from the 1st of December. They also decided to reduce, from and after Jan. 1, 1883, the price of gas for the city lamps from $1.90 to $1.80 per thousand.

This reduction will make about $10,000 difference in the profits of the company, while gas consumers, as a matter of course, will have the benefit of it. Notwithstanding this reduction in price, the company expect to keep up their 8 per cent. dividends to the stockholders. They intend also to give consumers the best quality of gas that can be manufactured; and it is to be hoped that they will adhere to this part of the programme. Seventeen candle power has been adopted as the standard light by the company.

The company is gradually extending its business. It has now over 70 miles of street mains in Hartford and vicinity. Its mains extend as far north as Wethersfield, and westward over the town line to West Hartford. Its pipes are now being extended to Trinity College. It has 3,900 meters in use.

This company was started in 1849, and the price of gas at that time was $4 per thousand feet. It has been the aim of the company to reduce the price from time to time to the lowest possible point, and at the same time protect its stockholders. The price of gas in this city is lower than in any other city similarly situated. There are some places, including those in the vicinity of the coal regions, where the prices may be lower, but there are few places which make as good a showing at the present time as the Hartford company.

Sheet Iron Gas Mains.

During the past few months the Paris Gas Company has been engaged in reorganizing a portion of their distributing plant, for the purpose of connecting the trunk mains in the principal central streets with their new station at Clichy-la-Garenne. All the main thoroughfares of the city have been affected in this operation. From the Place de l'Opera to the Courcelles gate, and thence along the national road to the works, the new main is one meter in diameter, and is made of bitumenized sheet iron. The pipes are laid in a bed of hot bitumen mixed with fine gravel—a pitch concrete, in short. This composition is said to acquire very great consistency and strength in cooling, and to protect the sheet iron so well that it does not at all deteriorate or oxidize, even in a soil saturated with damp. The pipes in the streets are placed underneath the pavement. It is worthy of notice how Continental gas engineers appear quite converted from cast to wrought iron mains, even to the size mentioned in the present example. With regard to the protective qualities of the bitumen, on which so much reliance is necessarily placed, it is not stated whether the work is carried on in all weathers. It would appear that heavy rain must materially interfere with this method of main laying.—*Scientific American.*

Correspondence

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

Method of Constructing Furnaces.

CINCINNATI, OHIO, Jan. 8, 1883.

To the Editor AMERICAN GAS LIGHT JOURNAL:

I built some furnaces at Jamestown, New York, last summer, somewhat on the plan of the Leigel furnaces. The furnaces are 4′3″ long, 4′6″ high, and 1′4″ wide, running down to an opening at the bottom of each through the lower arch. This opening is 2′6″ long and 2″ wide. There are hot air flues and chambers, with four openings over the fire on each side. The air passages are constructed with a view to tightness, and they form a chamber behind the furnace so as to admit of the thorough heating of the air. The hot air is let in above the fire and the combustion is almost perfect; looking into the benches in the daytime you cannot see any part of the settings; the heat is quite white.

The result, as reported to me by the managing owner, was that, from a bench of five retorts 15″ × 24″ × 9′, there was obtained 44,900 feet of gas in one day, or equal to about 9,000 cubic feet per retort; and this bench was running alone.

The ovens are 9′ × 7′ × 4″ wide, benches on the bridge-wall plan of settings. I built these furnaces very much after the plan of Messrs. Livesey and Somerville, of London, England, with three jets of steam running into the furnace, from the bottom, through the opening mentioned; they are in a double stage range of benches, where the ashes and the surplus coke fall direct to the basement, and the fires are charged with hot coke from the mouthpieces. I have directed the building of a good many benches and ranges of benches through the Western country during the past few years, partly on the same plan, with *coupe-feu* settings, but where there was no basement, and the furnaces could not have so much depth, say but 24″ to 30″; in these, as I could not judiciously reduce the width in the bottom, I have placed, in some of them, two grate bars of 4″ width, and one bar between them of 1½″ width, thus excluding a large portion of air that is taken up through the ordinary furnace. This idea of grate bars I credit to Mr. Salter, of Covington, and, taken in connection with the hot air flues, they work well and enable a better heat to be kept up. In all these benches high heats are claimed. In a great many gas works there is altogether too much cold air admitted through the fronts of the benches and through the furnaces.

Last winter I built a range of benches of fives at Lynchburgh, and a fear was even entertained by some that the heat would burn down the benches. But it did not. I think the most satisfactory furnace is the one at Jamestown. A couple of benches have been built this summer in the Oil City (Pa.) gas works, controlled by the same managing owner, on the same plan. The furnace is very similar to that in use in the Cincinnati gas works.

J. ANDERSON.

THE AMERICAN
GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
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TUESDAY, JANUARY 16, 1883.

The Main Reliance of the Gas Companies.

Editor *Shipping and Commercial List:*

Dear Sir—In your issue of Jan. 10, 1883, under the head of "Review of the Petroleum Market for 1882," and referring to naphtha, you say:

"Naphtha has become the main reliance of gas companies, yielding as it does an illuminator of superior quality at a less cost than coal."

This statement is so glaringly erroneous that it must have been furnished you by someone either entirely ignorant of the matter, or else interested in the promotion of one of the numerous schemes for the sale of patents to manufacture naphtha gas, so called. There are in New York six gas companies. Of these, four use bituminous coal and cannel, and are not in the least degree dependent on the use of naptha. These four companies supply over two-thirds of the gas used in New York city; the other two are manufacturing what is called water gas, and their main reliance is naphtha. Anyone at all acquainted with the manufacture of gas will realize how precarious and dangerous an element this is. Water gas has been supplied in New York by the two companies referred to for about five years, during which time some 80 deaths have occurred from the inhalation of this gas in the districts supplied by these companies—a circumstance which of itself should lead to its prohibition entirely, and it would if the Board of Health of New York did its duty. In the districts supplied by the bituminous coal gas such fatalities are entirely unknown. Every few days the public are furnished with glowing accounts of the formation of some new gas company owning some new naphtha patent, which is to supply gas at most ridiculously low prices. These schemes can all be traced to one source, and have for their object the sale of patents which are utterly without commercial value.

Taking the entire gas manufacture of the United States, it will be safe to say that not one per cent. of it is produced from naphtha.

The bituminous coal from West Pennsylvania and Virginia is the "main reliance" of the gas companies in the States, and this is found in almost unlimited quantities. The competition in its production enables gas companies to secure their supplies at a fair price at all times. Naphtha, on the other hand, as is well known, is controlled by one company, having the power to advance prices at will, or shut off the supply entirely. With this power in the hands of the greatest monopoly in the world, fortunate is it that naphtha is not the "main reliance of gas companies."

"MELAS.

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.
(with W. B. Scott & Co.,)
34 PINE STREET, NEW YORK CITY.

JANUARY 16, 1883.

☞ All communciations will receive particular attention
☞ The following quotations are based on the par value of $100 per share.

	Capital.	*Par.*	*Bid.*	*Asked*
Gas Co.'s of N. Y. City.				
Central	$466,000	50	75	85
Harlem	1,800,000	50	90	95
" Bonds	170,000			103
Manhattan	4,000,000	50	215	220
Metropolitan	2,500,000	100	182	187
" Bonds	658,000	..	106	108
Mutual	3,500,000	100	107	110x
" Bonds	1,500,000		100	102
Municipal	1,500,000	100	175	180
" Bonds	750,000		106	110
New York	4,000,000	100	110	115
Northern	270 000	50	42	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	108	112
Citizens	1,200,000	20	67	70
" S. F. Bonds	320,000	1000	105	107
Fulton Municipal	3,600,000	100	70	80
Peoples	1,000,000	10	43	47
" Bonds	290,000		104	107
" "	250,000	...	88	90
Metropolitan	1,000,000	100	75	80
Nassau	1,000,000	25	50	55
" Ctfs.	700,000	1000	90	93
Williamsburgh	1,000,000	50	50	55
" Bonds	1,000,000	...	100	101
Richmond Co., S. I.	300,000	50	70	75
" Bonds	40,000	—	—	—
Out of Town Gas Companies.				
Buffalo Mutual, N.Y	750,000	100	72	75
" Bonds	200,000	1000	95	100
Citizens, Newark	918,000	50	80	85
" " Bds.	124,000	—	105	...
Chicago Gas Co., Ills			150	155
Cincinnati G. & C. Co.			178	180
Consolidated, Balt.			41	42
Bonds			105	106
East Boston, Mass	220,000	25	122	128
Hannibal, Mo	100,000	100	95	100
Hartford, Conn	700,000	25	120	128
Halifax N. S	400,000	40	148	150
Hamilton, Ontario	150,000	40	117½	
Jersey City	750,000	20	155	160
Jacksonville, Ill	120,000	50	100	...
Lewistown Maine	400,000	100	—	100
Laclede St Louis Mo	1,200,000	100	117	—
Montreal, Canada	2,000,000	100	186	187
New Haven, Conn		25	144	—
Oakland, Cal			32	33
Peoples, Jersey City		...	75	80
" " Bds.			...	...
Pittsfield, Mass			120	130
Rochester, N. Y.		50	70	80
Wilmington, Del.		50	174	...
Yonkers		50	30	32
St. Louis Missouri	600,000	50	250	254
San Francisco Gas-Co., S. Fr'isco Cal.			55	57
Toledo, Ohio			95	97
Troy, Citizens	600,000	100	—	—
Washington, D. C	1,500,000	20	200	

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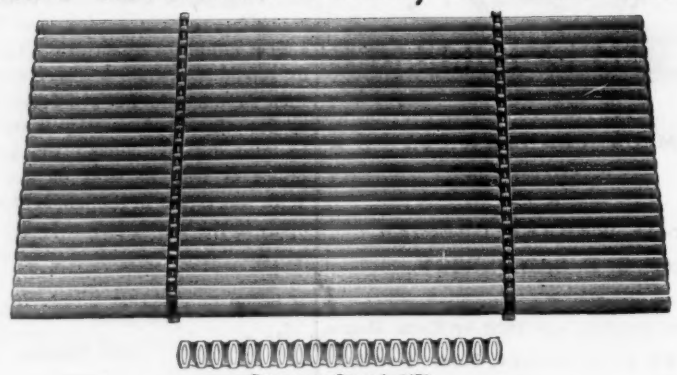

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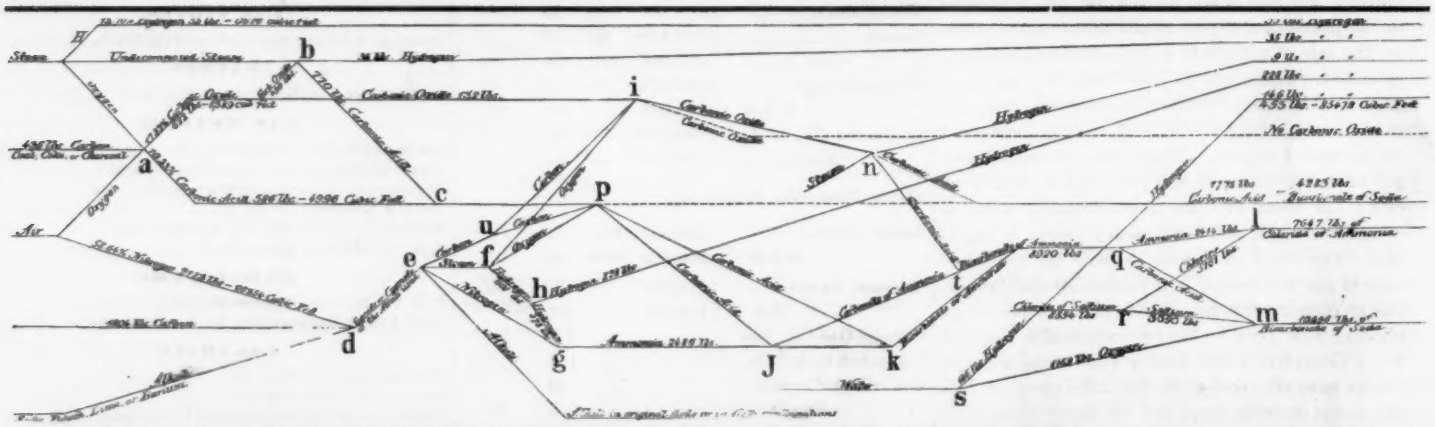

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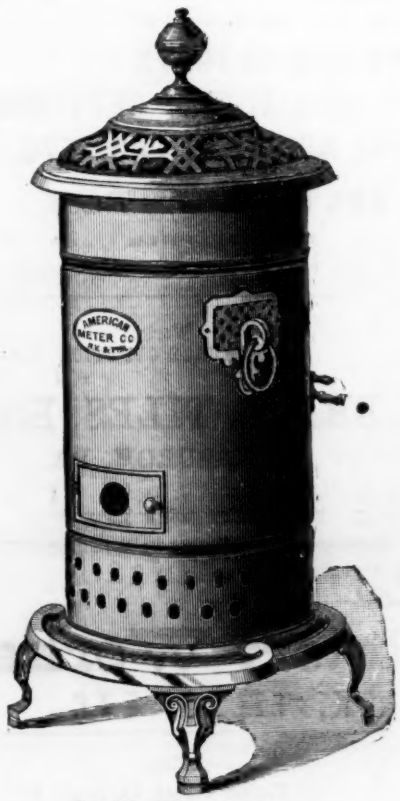

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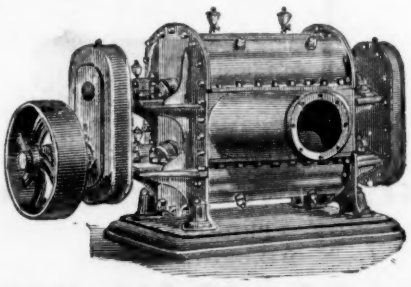

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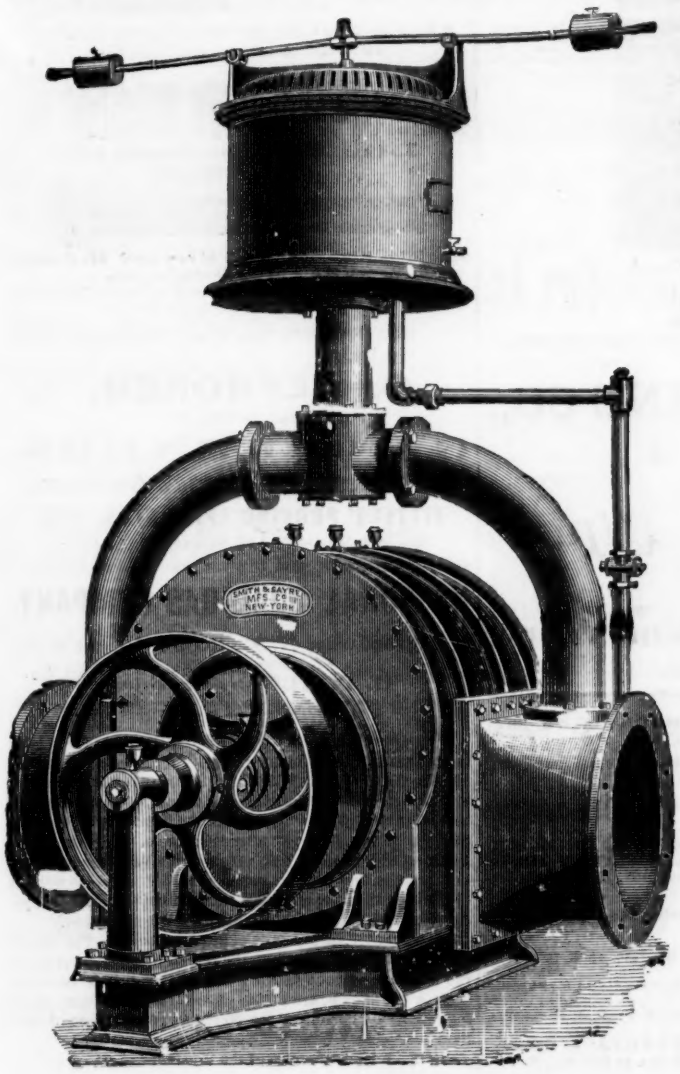

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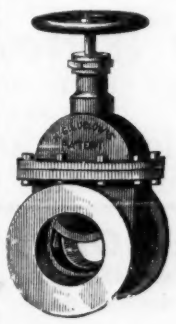

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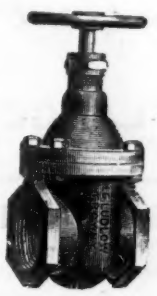

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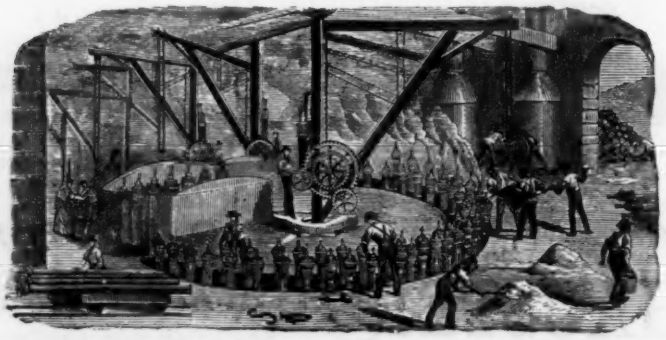

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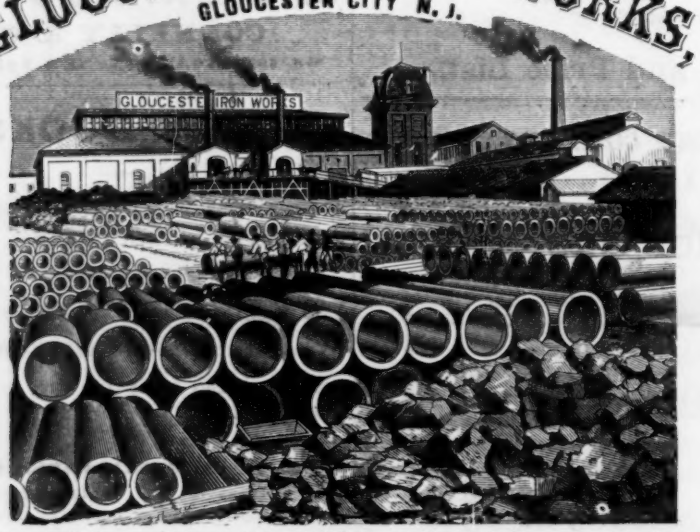

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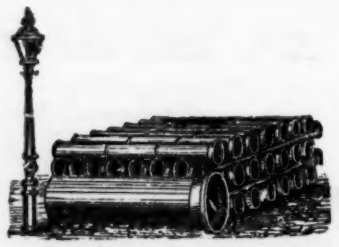

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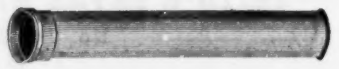

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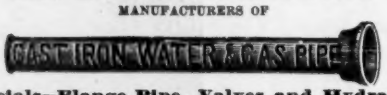

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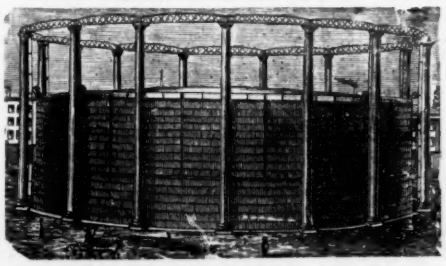

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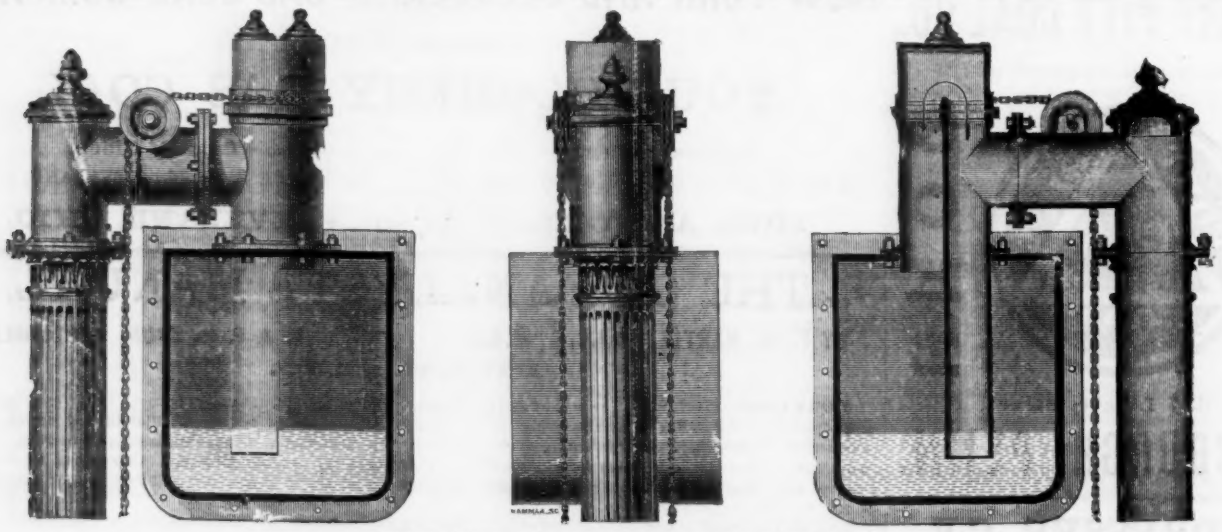

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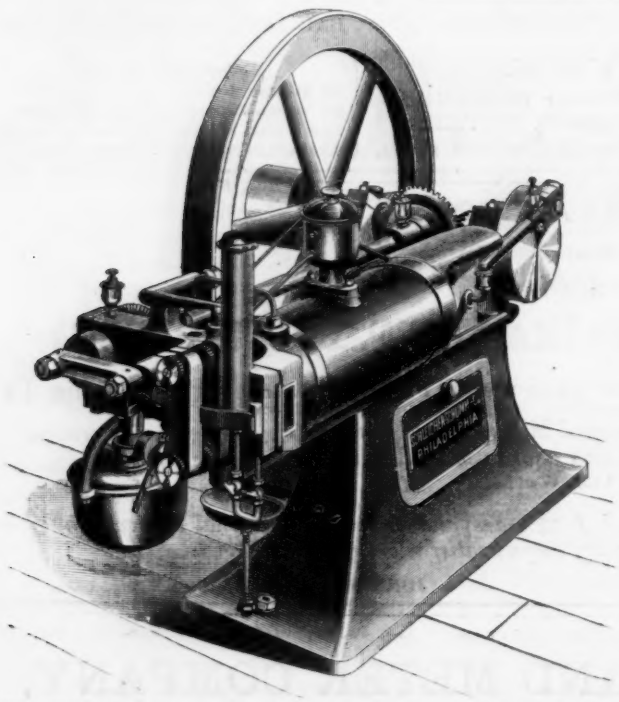

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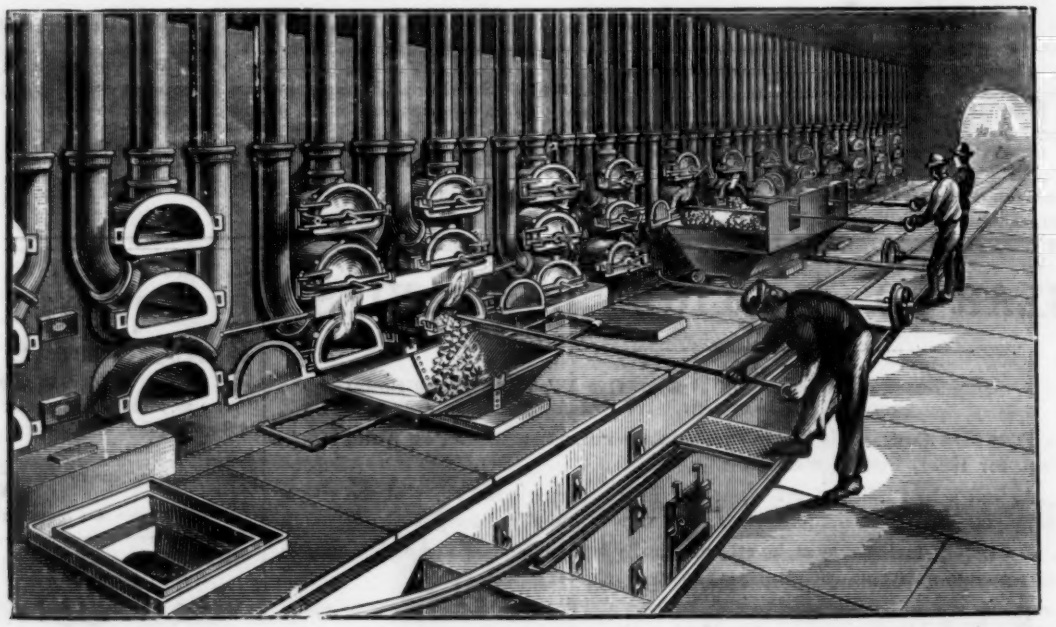

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